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Changes in the Names of Worms: The Rules of Zoological Nomenclature as applied to Veterinary Helminthology*

J. N. OLDHAM, B.Sc., PH.D.,

Senior Assistant in Parasitology, Research Institute in Animal Pathology, Royal Veterinary College, London

The changes in the names of parasitic helminths have been a source of perplexity, not to say annoyance, to everyone dealing with them. Particularly does this apply to such a person as the veterinary practitioner, who only occasionally finds them mentioned in the general literature and very naturally wonders why an old friend like *Strongylus gracilis* should suddenly appear under the name of *Trichostrongylus axei*. At first sight, changes of this kind appear to be an unnecessary complication of what has always been a wordy study; it may even be suspected that the helminthologist indulges in some sort of game

"And breeds in his fantastic brain
New maggots of nomenclature."

as a contributor to *Punch* puts it. A short account of the reasons for these changes may not be amiss here, and may remove the imputation that those who study parasitic worms are abnormal people and peculiar in their ideas on nomenclature.

An interesting comparison has been drawn in a paper which appeared in *The Naturalist* between the biologist and the chemist. The section reads as follows: "If you are going to talk about animals, it is as necessary that you should speak of them by their correct names as that a chemist should give the correct names and formulae of his compounds. A chemist to-day does not say that he has been experimenting with some salt of lead, or investigating a brown derivate of coal tar; no, he gives its precise name, which often is far more complicated than any name which the zoologist has to use." (Bather, 1926, *The Naturalist*, pp. 81-83.)

The changing of scientific names is not confined to parasitic worms, but is common to the whole field of zoology and is a very necessary process whereby order is gradually becoming established in what was a bewildering chaos of names. Thus, among the insects, the dog and cat fleas were long confused and placed together under the name *Pulex serraticeps* until Rothschild drew attention to the distinctions between the two species. It was also pointed out that they could not remain in the genus *Pulex* because they showed certain anatomical characters which differed from those used to identify this genus so that their names became *Ctenocephalus canis* and *Ctenocephalus felis*. In 1930, however, Stiles and Collins pointed out that *Ctenocephalus* was the name of a well-known trilobite and, incidentally, had also been (wrongly) used for a certain nematode. As it was thus shown to be "preoccupied" it could not be used again for an animal genus* and so they proposed the new name *Ctenocephalides* to meet the nomenclatorial situation. As a result the dog and cat fleas are now known as *Ctenocephalides canis* and *Ctenocephalides felis* respectively. The extent of the confusion which has obtained in the past becomes apparent when the literature dealing with any well-known species is examined. As an example of this, one might cite the tapeworm *Taenia solium*, which, since the year 1758, has been referred to under no less than ninety different names.

One reason for the appearance of many of these names has been the independent discovery of the same species of worm by different authors; the comparative isolation of the old-

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*The International Rules of Zoological Nomenclature allow of a plant generic name being used again in zoological nomenclature, but never of the same name being used for two different kinds of animals.

time workers and their lack of information about the work of other scientists are also largely responsible. But, apart from these reasons, scientific names were not given the respect which names in general should receive. No one would think of creating a new name for a spade when writing on that subject, yet scientific names have often been changed because of the personal caprice of an author who substituted a new one merely because he thought it a little more fitting, or because it sounded better.

To obviate this abuse of language and to bring about the very desirable state of affairs wherein each species should be known by one appellation only, a list of rules has been formulated by an international commission of scientists, to which all zoological nomenclature should conform. This code, known as *The International Code of Zoological Nomenclature*, is based upon rules laid down by Linnaeus in the tenth edition of his *Systema Naturae*, published in 1758, which is regarded as the starting point of consistent and orderly zoological nomenclature. An important item of the Code deals with the determination of the correct name of an animal where more than one has been used for it. The validity of a name is governed by the *Law of Priority*, which states that, prior to the 1st January, 1931, the oldest published name as far back as Linnaeus' work mentioned above shall be the true name, provided that it was published with an indication, definition or description by which it can be identified, and that the author using it had applied the principles of binary nomenclature. No names used before 1758 are valid, and if the name has been published since 1930 it must be accompanied by a summary of the characters which differentiate or distinguish the genus or species from other genera or species, or by a reference to such a summary; in the case of a generic name, there must be a definite unambiguous designation of the type species.

The use of the same generic name in more than one group of the Animal Kingdom is not permitted and an example has already been given of a change brought about by the application of this rule; this explains why the name *Trichina*, which had previously been used for a group of flies, was replaced by the name *Trichinella*. In the same way, although a specific name may be repeated *ad infinitum* in different genera, it cannot be used more than once in the same genus. In a number of cases the larval stage of a worm was found and described before the adult had been discovered and, according to the rules, the first name given to any stage in the life-cycle of an animal takes precedence over a later one even when that first name was used to designate the larva.

The wisdom of these conditions is not difficult to find; the impossible position of two animals with the same scientific name is self-evident; to give standing to any name which had not appeared in a recognised publication would greatly retard the final stabilisation; while such a name as *Hydatidis solitaria cervi axis* tries to describe the worm and its position as well as name it, which is more than a name can be expected to do. As regards the right of name by priority, it might at first appear that common use would have been a better criterion and have led to less confusion in the choice of a name from any given list; but a name in common use in one country, or among one group of workers, frequently differed from that used elsewhere, and such a principle could not be applied in any international scheme. Other methods of deciding upon the correct name had their disadvantages, and the principle of the choice of name by priority was thought to be both the fairest and the best for general application. This law is responsible for a great many of the alterations which have been made in the names of worms; such changes, however, represent, not the introduction of new names, but a return to earlier ones which have been wrongly ousted.

Another common reason for altering the names of worms is the recognition of a multiplicity of species where only one was thought to exist, an example of this having already been given in the change of names of the dog and cat fleas. The number of species of parasitic worms has been found to be very much greater than had been supposed by the old-time parasitologists; several thousands of species of parasitic nematodes alone have been described, and accounts of new species appear in almost every publication of journals dealing with the subject. The existing genera were not nearly adequate to hold such a large number of species; at one time or another more than three hundred different species have been ascribed to the genus *Strongylus*, and the use of genera of such wide limits would signify the absence rather than the employment of any classification, and render the work within the group much too difficult. For these reasons most of the older genera have been subdivided, with a resulting change in the first, or generic, name only; thus *Strongylus contortus* has become *Haemonchus contortus* and *Strongylus ovinus*, *Chabertia ovina*.

Enough has been said to show that these changes are at least rational, and are leading to a proper system in which each species will be known under one and the same appellation in every country. In order that the procedure shall be the more rational, a note has been added to the rules stating that plenary power

is conferred upon the International Commission on Zoological Nomenclature to suspend them in any given case where, in its judgment, their strict application will clearly result in greater confusion rather than in uniformity. Thus a list of arbitrarily fixed names, which will be used as correct and final despite any infraction of the code, is in process of compilation.

Definite rules governing the use of an author's name with a scientific name are to be found in the Code. Usually the author's name, in roman type, follows the specific or group name without any punctuation mark; the year of publication, separated by a comma from the author's name, is added in most cases. When a species has subsequently been removed to a different genus, the name of the second author and year are given, following the name and year of the first author, which are placed within brackets. Thus, *Strongylus contortus* Rudolphi, 1803, indicates that Rudolphi described this worm in 1803 and placed it in the genus *Strongylus*; in 1898, however, Cobb transferred it to the genus *Haemonchus*, and the parasite then became *Haemonchus contortus* (Rud., 1803) Cobb, 1898. Although the use of the author's name and date is not obligatory, it greatly assists the identification of species when confusion of specific names has occurred.

A list of the correct names of worms as now generally accepted, and some of the commoner synonyms, is appended. In some instances where the division of an old genus has been proposed but has not been generally accepted, both old and new generic names are given. While this list cannot be regarded as in any way complete or final, and there are points in it on which expert opinion might differ, it should be of some assistance to the practitioner and to those who do not have ready access to the literature of helminthology. In the list the species marked * are known either not to occur or to occur only very rarely in the British Isles.

Trematodes

Dicrocoelium dendriticum (Rudolphi, 1819) Looss, 1899.
Distoma dendriticum Rudolphi, 1819.
Fasciola lanceolata Rud., 1803, *nec* Schrank, 1790.
Distoma lanceolatum (Rud., 1803) Mehlis, 1825.
Distoma (Dicrocoelium) lanceolatum (Rud., 1803) Dujardin, 1845.
Distomum lanceolatum (Rud., 1803) Diesing, 1850.
Dicrocoelium lanceolatum (Rud., 1803) Weinland, 1858.
Dicrocoelium lanceatum Stiles and Hassall, 1896.

**Echinochasmus perfoliatus* (v. Rátz, 1908) Dietz, 1910.
Echinostomum perfoliatum v. Rátz, 1908.
Echinostomum gregale Railliet and Henry, 1909.

**Fasciola gigantica* Cobbold, 1855.
Distomum giganteum Diesing, 1858.
Cladocoelium giganteum (Dies., 1858) Stossich, 1892, *e.p.*
Fasciola gigantea (Dies., 1858) Cobb., 1858.

Fasciola hepatica Linnaeus, 1758.
Planaria latiuscula Goeze, 1782.
Distoma hepaticum (Linn., 1758) Abildgaard (?).
Distoma (Cladocoelium) hepaticum (Linn., 1758) Dujardin, 1845.
Distomum hepaticum (Linn., 1758) Diesing, 1850.
Cladocoelium hepaticum (Linn., 1758) Stossich, 1892.

**Fasciola magna* (Bassi, 1875) Stiles, 1894.
Distomum magnum Bassi, 1875.
Fasciola americana Hassall, 1891.
Distomum texanicum Francis, 1891.
Fasciola carnosa Hassall, 1891.
Distomum americanum (Hassall, 1891) Stiles, 1892.
Cladocoelium giganteum (Diesing, 1858) Stossich, 1892, *e.p.*
Fascioloides magna (Bassi, 1875) Ward, 1917.

**Gastrodiscus aegyptiacus* (Cobbold, 1876) Railliet, 1893.
Diplostomum aegyptiacum Cobbold, 1876.
Hemistoma aegyptiaca (Cobbold, 1876) Cobbold, 1876.
Gastrodiscus sonsinoii Cobbold, 1877.
Gastrodiscus polymastos Leuckart, 1880.

**Opisthorchis tenuicollis* (Rudolphi, 1819) Stiles and Hassall, 1896.
Distoma tenuicolle Rudolphi, 1819.
Distomum felineum Rivolta, 1884.
Distomum viverrini Poirier, 1886.
Opisthorchis felineus (Rivolta, 1884). Blanchard, 1895.
Opisthorchis viverrini (Poir., 1886) Stiles and Hassall, 1896.

Paramphistomum cervi (Schrank, 1790). Fischoeder, 1901.
Fasciola cervi Schrank, 1790.
Festucaria cervi Zeder, 1790.
Monostoma conicum Zeder, 1803.
Amphistoma conicum (Zeder, 1803) Rudolphi, 1809.
Amphistoma cervi (Schrank, 1790) Stiles, 1898.

**Prosthogonimus pellucidus* (v. Linstow, 1873) Braun, 1901.
Prosthogonimus intercalandus Hieronymi and Szidat, 1921.

**Schistosoma bovis* (Sonsino, 1876) Blanchard, 1895.
Bilharzia bovis Sonsino, 1876.
Bilharzia crassa Sonsino, 1878.
Gynaecophorus crassus (Sons., 1878) Stossich, 1892.
Gynaecophorus bovis (Sons., 1876) Railliet, 1893.
Schistosoma crassum (Sons., 1878) Looss, 1899.

Cestodes

**Amoebotaenia sphenoides* (Railliet, 1892) Cohn, 1899.
Dicranotaenia sphenoides (Railliet, 1892) Railliet, 1896.
Taenia cuneata v. Linstow, 1872, *nec* Batsch, 1786.

**Anoplocephala magna* (Abildgaard, 1789) Spengel, 1905.
Taenia equina Pallas, 1781, *e.p.*
Taenia magna Abildgaard, 1789.
Taenia plicata (Zeder, 1800) Rudolphi, 1805.
Taenia zebrae Rudolphi, 1808.

**Anoplocephala mamillana* (Mehlis, 1831) Blanchard, 1891.
Taenia perfoliata Goeze, 1782, *e.p.*
Taenia mamillana Mehlis, 1831.
Anoplocephaloides mamillana Mehl., 1831) Baer, 1924.
Paranoplocephala mamillana (Mehl., 1831) Baer, 1927.
Anoplocephaloides mamillana (Mehl., 1831) Blanchard, 1848.
Taenia equina Pallas, 1781, *e.p.*
Taenia equina perfoliata Goeze, 1782.
Taenia perfoliata Goeze, 1782.

Choanotaenia infundibulum (Bloch, 1779) Cohn, 1899.
Taenia infundibulum Bloch, 1779.
Taenia infundibuliformis Goeze, 1782.
Drepanidotaenia infundibuliformis (Gze., 1782) Railliet, 1893.
Choanotaenia infundibuliformis (Gze., 1782) Railliet, 1896.
Monopylidium infundibuliformis (Gze., 1782) Clerc, 1903.
Monopylidium infundibulum (Bloch, 1779). Kowalevski, 1904.
Monopylidium infundibuliforme (Goeze, 1782) Fuhrmann, 1908.

Davainea proglottina (Davaine, 1860) Blanchard, 1891.
Taenia proglottina Davaine, 1860.

**Diphyllobothrium latum* (Linnaeus, 1758) Lühe, 1910.
Taenia lata Linnaeus, 1758.
Bothriocephalus latus (Linn., 1758) Bremser, 1819.
Dibothrium latum (Linn., 1758) Diesing, 1850.
Dibothriocephalus latus (Linn., 1758) Lühe, 1899.

Dipylidium caninum (Linnaeus, 1758) Railliet, 1892.
Taenia canina Linnaeus, 1758.
Taenia cucumerina Bloch, 1782.
Taenia elliptica Goeze, 1782.
Taenia cateniformis Goeze, 1782, *e.p.*
Taenia cuneiceps (Zeder, 1800) Rudolphi, 1810.

Echinococcus granulosus (Batsch, 1786) Rudolphi, 1805.
Hydatigena granulosa Batsch, 1786.
Echinococcus veterinorum Rudolphi, 1810.
Echinococcus polymorphus Diesing, 1850.
Taenia echinococcus v. Siebold, 1853.
Echinococcifer echinococcus (v. Sieb., 1853) Weinland, 1861.

Moniezia benedeni (Moniez, 1879) Blanchard, 1891.
Taenia benedeni Moniez, 1879.
Moniezia planissima Stiles and Hassall, 1892.
Moniezia neumanni Moniez, 1891.
Moniezia triangularis Marotel, 1912.
Moniezia pelucida Bleis., 1920.
Moniezia translucida Jenkins, 1923.

Moniezia expansa (Rudolphi, 1810) Blanchard, 1891.
Taenia expansa Rudolphi, 1810.
Moniezia nullicollis Moniez, 1891.
Moniezia trigonophora Stiles and Hassall, 1892.
Moniezia oblongiceps Stiles and Hassall, 1893.
Moniezia minima Marotel, 1912.

Raillietina (Skrjabinia) cesticillus (Molin, 1858) Joyeux, 1923.
Taenia cesticillus Molin, 1858.
Davainea cesticillus (Molin, 1858) Blanchard, 1891.
Brumptiella cesticillus (Molin, 1858) Lopez-Neyra, 1931.

Raillietina (Raillietina) echinobothrida (Mégnin, 1880) Joyeux, 1923.
Taenia echinobothrida Mégnin, 1880.
Taenia botrioplites Piana, 1881.
Davainea echinobothrida (Mégnin, 1880) Blanchard, 1891.

Raillietina (Raillietina) tetragona (Molin, 1858) Joyeux, 1923.
Taenia tetragona Molin, 1858.
Davainea tetragona (Molin, 1858) Blanchard, 1891.

Taenia hydatigena Pallas, 1766.
Hydatigena orbicularis Goeze, 1782.
Hydatigena globosa Batsch, 1786.
Taenia marginata Batsch, 1786.
Taenia globosa (Batsch, 1786) Gmelin, 1790.
Cysticercus tenuicollis Rudolphi, 1810.

Taenia multiceps Leske, 1780.
Hydatigena cerebralis Batsch, 1786.
Taenia cerebralis (Batsch, 1786) Gmelin, 1790.
Coenurus cerebralis (Batsch, 1786) Rudolphi, 1808.
Polycephalus coenurus Tschudi, 1837.
Taenia coenurus (Tschudi, 1837). Küchenmeister, 1853.
Multiceps multiceps (Leske, 1780) Hall, 1910.

**Taenia ovis* (Cobbold, 1869).
Cysticercus ovis Cobbold, 1869.
Cysticercus oviparіens Maddox, 1873.
Cysticercus oviparus Leuckart, 1886.

Taenia pisiformis (Bloch, 1780) Gmelin, 1790.
Hydatigena pisiformis (Bloch, 1780) Goeze, 1782.
Cysticercus pisiformis (Bloch, 1780) Zeder, 1803.
Taenia serrata auctt., *nec* Goeze, 1782.
Taenia novella Neumann, 1896.

Taenia saginata Goeze, 1782.
Taenia mediocanellata Küchenmeister, 1852.
Taenia inermis Moquin-Tandon, 1860.
Cysticercus bovis Cobbold, 1866.
Taeniarhynchus mediocanellata (Küch., 1852) Blanchard, 1886.
Taeniarhynchus saginatus (Goeze, 1782) Rochebrune, 1897.

Taenia serialis (Gervais, 1847) Baillet, 1863.
Coenurus serialis Gervais, 1847.
Coenurus cuniculi (Diesing, 1863) Cobbold, 1864.
Multiceps serialis (Gervais, 1847) Stiles and Stevenson, 1905.

**Taenia solium* Linnaeus, 1758.
Taenia cucurbitina Pallas, 1766.
Taenia cellulosae Gmelin, 1790.
Cysticercus cellulosae (Gmelin, 1790) Rudolphi, 1808.
Taenia armata Brera, 1802.

Taenia taeniaeformis (Batsch, 1786) Wolffhügel, 1911.
Vermis vesicularis teniaeformis Bloch, 1780.
Taenia serrata Goeze, 1782.
Hydatigena taeniaeformis Batsch, 1786.
Taenia murina Gmelin, 1790, *nec* Dujardin, 1845.
Cysticercus fasciolaris Rudolphi, 1808.
Taenia crassicollis Rudolph, 1810.
Hydatigera fasciolaris (Rud., 1808) Lamarck, 1816.
Hydatigena fasciolaris (Rud., 1808) Diesing, 1850.

**Thysanosoma actinioides* Diesing, 1835.
Taenia fimbriata Diesing, 1850.
Moniezia fimbriata (Dies., 1850) Moniez, 1891.

NEMATODES

Aelurostrongylus abstrusus (Railliet, 1898) Cameron, 1927.
Strongylus pusillus Muell., 1890, *nec* Rudolphi, 1803.
Strongylus abstrusus Railliet, 1898.
Synthetocaulus abstrusus (Railliet, 1898) Railliet, 1907.

Amidostomum nodulosum (Rudolphi, 1803).
Strongylus nodulosus Rudolphi, 1803.
Strongylus nodularis Rudolphi, 1809.
Strongylus anseris Zeder, 1800, *e.p.*
Ascaris mucronata Froel., 1791, *nec* Schrank, 1780.
Amidostomum anseris (Zeder, 1800) auctt., *e.p.*

**Ancylostoma caninum* Ercolani, 1859.
Sclerostoma caninum Ercolani, 1859.
Strongylus caninus Ercolani, 1859.
Dochmius trigonocephalus (Rud., 1808) of Ercolani, 1859, *e.p.*
Uncinaria trigonocephala Railliet, 1885.
Uncinaria canina (Erc., 1859) Railliet, 1900.

Ascaridia galli (Schrank, 1788) Freeborn, 1923.
Ascaris galli Schrank, 1788.
Ascaris gallopavonis Gmelin, 1790.
Ascaris inflexa (Zeder, 1800) Rudolphi, 1809.
Ascaris (*Ascaridia*) *inflexa* (Zeder, 1800) Dujardin, 1845.
Ascaris (*Ascaridia*) *perspicillum* (Rudolphi, 1803) Dujardin, 1845.
Heterakis inflexa (Zeder, 1800) Schneider, 1866.
Heterakis lineata Schneider, 1866.
Ascaridia lineata (Schneider, 1866) Railliet and Henry, 1912.
Ascaridia hamia Lane, 1914.

Ascaris equorum Goeze, 1782.
Ascaris equi Schrank, 1788.
Ascaris megalocephala Cloquet, 1824.
Parascaris equorum (Goeze, 1782) Yorke and Maplestone, 1926.

Ascaris lumbricoides Linnaeus, 1758.
Ascaris gigas Goeze, 1782.
Ascaris suum Goeze, 1782.
Ascaris suis Gmelin, 1790.
Fusaria lumbricoides (Linn., 1758) Zeder, 1800.
Ascaris ovis Rudolphi, 1819.
Ascaris suilla Dujardin, 1845.

Bosicola radiatus (Rudolphi, 1803) Baylis, 1936.
Strongylus radiatus Rudolphi, 1803.
Strongylus inflatus Schneider, 1866. *nec* Molin, 1861.
Strongylus dilatatus Railliet, 1884.
Oesophagostomum inflatum (Schneider, 1866) Railliet, 1885.
Oesophagostomum dilatatum (Railliet, 1884) Railliet, 1896.
Oesophagostomum vesiculosum Rátz, 1898.
Oesophagostomum radiatum (Rud., 1803) Railliet, 1898.
Oesophagostomum bovis Schnyder, 1906.
Bosicola tricollaris Sandground, 1929.

**Bunostomum phlebotomum* (Railliet, 1900) Railliet, 1902.
Strongylus radiatus Schneider, 1866, *nec* Rudolphi, 1803.
Uncinaria radiata Railliet, 1885.
Monodontus phlebotomus Railliet, 1900.
Bunostomum radiatum v. Linstow, 1906.

Bunostomum trigonocephalum (Rudolphi, 1808) Railliet, 1902.
Strongylus trigonocephalus Rudolphi, 1808, *e.p.*
Strongylus cernuus Creplin, 1829.
Monodontus trigonocephalus (Rud., 1808) Railliet, 1902.
Sclerostoma hypostomum (Rud., 1819) Dujardin, 1845, *e.p.*
Uncinaria cernua (Creplin, 1829) Railliet, 1885.
Dochmius cernuus (Creplin, 1829) Baillet, 1868.

Capillaria aërophila (Creplin, 1839) Railliet, 1915.
Trichosomum aërophilum Creplin, 1839.
Eucoleus aërophilus (Creplin, 1839) Dujardin, 1845.

Chabertia ovina (Gmelin, 1790).
Strongylus ovinus Gmelin, 1790.
Strongylus contortus Rudolphi, 1802, *e.p.*
Strongylus hypostomus Rudolphi, 1819.
Sclerostoma hypostomum (Rud., 1819) Dujardin, 1845, *e.p.*
Dochmius hypostomus Diesing, 1851, *e.p.*
Sclerostomum hypostomum Leuckart, 1867.
Sclerostomum ovinum Stossich, 1899.

Choerostrongylus pudendotectus (Wostokow, 1905) Skrjabin, 1924.
Metastrongylus pudendotectus Wostokow, 1905.
Metastrongylus brevivaginatus Railliet and Henry, 1907.

Cooperia curticei (Railliet, 1893) Railliet and Henry, 1909.
Strongylus ventricosus Rudolphi, 1809 of Curtice, 1890.
Strongylus curticii Giles, 1892.
Strongylus curticei Railliet, 1893 (emendation for *curticii*).

Cooperia oncophora (Railliet, 1898) Ransom, 1907.
Strongylus radiatus Rudolphi, 1803, *e.p.*
Strongylus ventricosus Rudolphi, 1809 of Schneider, 1866, *e.p.*
Strongylus oncophorus Railliet, 1898.

**Cooperia pectinata* Ransom, 1907.
Cooperia nicolli Baylis, 1929.

**Cooperia punctata* (Linstow, 1007) Ransom, 1907.
Strongylus punctatus Linstow in Schnyder, 1907.
Cooperia fieldingi Baylis, 1929.

Crenosoma vulpis (Dujardin, 1845) Railliet, 1915.
Liorhynchus vulpis Dujardin, 1845.
Strongylus decoratus Creplin, 1847.
Strongylus annulatus Siebold, 1848.
Strongylus lupi Molin, 1861, *nec* Rudolphi, 1809.
Crenosoma semiarmatum Molin, 1861.

Dictyocaulus arnfieldi (Cobbold, 1884) Railliet and Henry, 1907.
Strongylus arnfieldi Cobbold, 1884.
Metastrongylus arnfieldi (Cobb., 1884) Slinter and Swellengrebel, 1912.

Dictyocaulus filaria (Rudolphi, 1809) Railliet and Henry, 1907.
Strongylus filaria Rudolphi, 1809.

Dictyocaulus viviparus (Bloch, 1782) Railliet and Henry, 1907.
Gordius viviparus Bloch, 1782.
Ascaris vituli Gmelin, 1790.
Strongylus vitulorum Rudolphi, 1809.
Strongylus micrurus Mehlis, 1831.
Dictyocaulus micrurus (Mehlis, 1831) Railliet, 1915.

**Dioctophyme renale* (Goeze, 1782) Stiles, 1901.
Ascaris renalis Goeze, 1782.
Ascaris visceralis Gmelin, 1790.
Strongylus gigas Rudolphi, 1802.
Eustrongylus gigas (Rud., 1802) Diesing, 1851.
Dioctophyme gigas (Rud., 1802) Stiles and Hassall, 1894.

**Dirofilaria immitis* (Leidy, 1856) Railliet and Henry, 1911.
Filaria immitis Leidy, 1856.
Filaria haematica Leuckart, 1867.
Spiroptera immitis (Leidy, 1856) Ercolani, 1875.

**Dracunculus medinensis* (Linnaeus, 1758) Gallandat, 1773.
Gordius medinensis Linnaeus, 1758.
Vena medinensis (Linn., 1758) Gallandat, 1773.
Filaria medinensis (Linn., 1758) Gmelin, 1790.

**Draschia megastoma* (Rudolphi, 1819) Chitwood and Wehr, 1934.
Spiroptera megastoma Rudolphi, 1819.
Spirura megastoma (Rud., 1819) Blanchard, 1849.
Habronema megastoma (Rud., 1819) Seurat, 1914.

**Gongylonema pulchrum* Molin, 1857.
Spiroptera scutata Müller, 1869.
Gongylonema scutatum (Müller, 1869) Railliet, 1892.
Myzomimus scutatus (Müller, 1869) Stiles, 1892.
Gongylonema ransomi Chapin, 1922.

Habronema microstoma (Schneider, 1866) Ransom, 1911.
Filaria microstoma Schneider, 1866.
Spiroptera microstoma (Schneider, 1866) Zürn, 1872.

**Habronema muscae* (Carter, 1861) Diesing, 1861.
Filaria muscae Carter, 1861.
Spirura muscae (Carter, 1861) Marotel, 1913.

Haemonchus contortus (Rudolphi, 1803) Cobb, 1898.
Strongylus contortus Rudolphi, 1803.

Heterakis gallinae (Gmelin, 1790) Freeborn, 1923.
Ascaris papillosa Bloch, 1782, *e.p.*
Ascaris gallinae Gmelin, 1790.
Ascaris vesicularis Frölich, 1791, *e.p.*
Heterakis papillosa auctt., *e.p.*
Heterakis vesicularis (Frölich, 1791). Dujardin, 1845.

Hyostrongylus rubidus (Hassall and Stiles, 1892) Hall, 1921.
Strongylus attenuatus Molin, 1860, *nec* Leidy, 1856.
Strongylus rubidus Hassall and Stiles, 1892.
Strongylus molini Railliet, 1898.
Haemonchus rubidus (H. and S., 1892) Slinter and Swellengrebel, 1912.
Ostertagia rubida (H. and S., 1892) Travassos, 1921.

Metastrongylus elongatus (Dujardin, 1845) Railliet and Henry, 1911.
Ascaris apri Gmelin, 1790, *e.p.*
Strongylus suis Rudolphi, 1809, *e.p.*
Strongylus paradoxus Mehlis, 1831, *e.p.*
Strongylus elongatus Dujardin, 1845.
Strongylus longevaginatus Diesing, 1851.
Metastrongylus paradoxus (Mehlis, 1831) Molin, 1861.
Metastrongylus longevaginatus (Dies., 1851) Molin, 1861.
Metastrongylus apri (Gmel., 1790) Railliet and Henry, 1907.

Muellerius capillaris (Müller, 1889) Cameron, 1927.
Pseudalius capillaris Müller, 1889.
Strongylus capillaris (Müller, 1889) Schlegel, 1899.
Synthetocaulus capillaris (Müller, 1889) Railliet and Henry, 1907.

Nematodirus filicollis (Rudolphi, 1802) Ransom, 1907.
Ascaris filicollis Rudolphi, 1802.
Strongylus filicollis (Rud., 1802) Rudolphi, 1803.
Trichostrongylus filicollis (Rud., 1802) Slinter and Swellengrebel, 1912.

Nematodirus spathiger (Railliet, 1896) Railliet and Henry, 1909.
Strongylus spathiger Railliet, 1896.

Oesophagodontus robustus (Giles, 1892) Railliet and Henry, 1902.
Sclerostoma robustum Giles, 1892.
Pseudosclerostomum securiferum Quiel, 1919.

**Oesophagostomum columbianum* (Curtice, 1890) Stossich, 1899.
Oesophagostoma columbianum Curtice, 1890.
Hypostomum columbiana (Curtice, 1890) Stewart, 1898.

Oesophagostomum dentatum (Rudolphi, 1803) Molin, 1861.
Strongylus dentatus Rudolphi, 1803.
Sclerostoma dentatum (Rudolphi, 1803) de Blainville, 1828.
Oesophagostomum subulatum Molin, 1861.

Oesophagostomum venulosum (Rudolphi, 1809) Railliet, 1885.
Strongylus venulosus Rudolphi, 1809.
Oesophagostomum acutum Molin, 1861.

Ollulanus tricuspis Leuckart, 1865.

Onchocerca reticulata Diesing, 1841.
Trichina reticulata Diesing, 1841.
Filaria reticulata (Dies., 1841) Creplin, 1846.
Spiroptera cincinnata Ercolani, 1866.
Spiroptera reticulata (Dies., 1841) Railliet, 1885.
Onchocerca cervicalis Railliet and Henry, 1910.

Oslerus osleri (Cobbold, 1879) Hall, 1921.
Strongylus canis bronchialis Osler, 1877.
Filaria osleri Cobbold, 1879.
Pseudalius osleri (Cobb., 1879) Railliet, 1915.
Filaroides osleri (Cobb., 1879) Skrjabin, 1933.

Ostertagia circumcincta (Stadelmann, 1894) Ransom, 1907.
Strongylus circumcinctus Stadelmann, 1894.
Strongylus cervicornis M'Fadyean, 1897, *e.p.*

Ostertagia ostertagi (Stiles, 1892) Ransom, 1907.
Strongylus convolutus Ostertag, 1890, *nec* Kuhn, 1829.
Strongylus ostertagi Stiles, 1892.

Ostertagia trifurcata Ransom, 1907.

Oxyuris equi (Schrank, 1788) Blanchard, 1849.
Trichocephalus equi Schrank, 1788.
Mastigodes equi Zeder, 1803.
Oxyuris curvula Rudolphi, 1803.
Oxyuris mastigodes Nitzsch, 1857.
Lepturis curvula (Rud., 1803) Schlotthauber, 1860.

Passalurus ambiguus (Rudolphi, 1819) Dujardin, 1845.
Oxyuris ambigua Rudolphi, 1819.

**Physocephalus sexalatus* (Molin, 1860) Diesing, 1861.
Spiroptera sexalata Molin, 1860.
Spiroptera strongylina Linstow, 1879, *nec* Rudolphi, 1819.
Filaria strongylina Perroncito, 1891, *nec* Schneider, 1866.

Probstmayria vivipara (Probstmayr, 1865) Ransom, 1907.
Oxyuris vivipara Probstmayr, 1865.
Anguillula vivipara (Probst., 1865) Railliet, 1893.
Strongyloides viviparus (Probst., 1865) Linstow, 1905.

Protostrongylus rufescens (Leuckart, 1865) Kamensky, 1905.
Strongylus rufescens Leuckart, 1865.

Strongylus minutissimus Mégnin, 1878.
Synthetocaulus rufescens (Leuck., 1865) Railliet and Henry, 1907.
Metastrongylus rufescens (Leuck., 1865) Slinter and Swellengrebel, 1912.
**Setaria cervi* (Rudolphi, 1819) Baylis, 1936.
Filaria cervi Rudolphi, 1819.
Filaria cervina Dujardin, 1845.
Filaria terebra Diesing, 1851, *e.p.*
Filaria bidentata Molin, 1858.
Filaria labiato-papillosa Perroncito, 1882.
Filaria digitata Linstow, 1906.
Setaria bidentata (Molin, 1858) Railliet and Henry, 1911.
Setaria labiato-papillosa (Perr., 1882) Railliet and Henry, 1911.
Setaria digitata (Linstow, 1906) Railliet and Henry, 1911.
Setaria equina (Abildgaard, 1789) Railliet and Henry, 1911.
Gordius equinus Abildgaard, 1789.
Filaria equina (Abildg., 1789) Blanchard, 1849.
Filaria equi Gmelin, 1790.
Filaria papillosa Rudolphi, 1802.
Filaria palpebralis auctt., *e.p.*
**Stephanurus dentatus* Diesing, 1839.
Sclerostoma pinguicola Verrill, 1870.
Strongylus dentatus (Dies., 1839) Dean, 1874 (*nec* Rudolphi, 1803).
Stephanurus nattereri Cobbold, 1879.
Sclerostomum renium Drabble, 1922.
Strongyloides papillosus (Wedl, 1856) Ransom, 1911.
Trichosoma papillosum Wedl, 1856.
Rhabdonema longus Grassi, 1885.
Strongylus (*Alfortia*) *edentatus* (Looss, 1900) Railliet and Henry 1909.
Sclerostoma edentatum Looss, 1900.
Strongylus (*Strongylus*) *equinus* (Müller, 1780) Looss, 1900.
Strongylus equorum Zeder, 1800, *e.p.*
Strongylus armatus Rudolphi, 1802, *e.p.*
Sclerostoma equinum (Müller, 1780) de Blainville, 1828.
Strongylus neglectus Poeppel, 1897.
Strongylus (*Delafondia*) *vulgaris* (Looss, 1900) Railliet and Henry, 1909.
Sclerostoma vulgare Looss, 1900.
Syngamus trachea (Montagu, 1811) Chapin, 1925.
Fasciola trachea Montagu, 1811.
Syngamus trachealis v. Siebold, 1836.
Strongylus pictus Creplin, 1849.
Syngamus primitivus Molin, 1860.
Toxascaris leonina (Linstow, 1902) Railliet and Henry, 1911.
Ascaris cati Schrank, 1788, *e.p.*
Ascaris leptoptera Rudolphi, 1809, *e.p.*
Ascaris leonina Linstow, 1902.
Toxascaris marginata (Rud., 1802) of Leiper, 1907.
Toxascaris limbata Railliet and Henry, 1911.
Toxocara canis (Werner, 1782) Stiles, in Stiles and Hassall, 1905.
Lumbricus canis Werner, 1782.
Ascaris vulpis Frölich, 1789.
Ascaris triquetra Schrank, 1790.
Ascaris marginata Rudolphi, 1802.
Belascaris marginata (Rud., 1802) Railliet and Henry, 1911.
Toxocara mystax (Zeder, 1800).
Ascaris cati Schrank, 1788, *e.p.*
Fusaria mystax Zeder, 1800.
Ascaris mystax (Zeder, 1800) Rudolphi, 1802.
Ascaris leptoptera Rudolphi, 1809, *e.p.*
Belascaris mystax (Zeder, 1800) Castellani and Chalmers, 1910.
Belascaris cati (Schrank, 1788) Railliet and Henry, 1911.
**Trichinella spiralis* (Owen, 1835) Railliet, 1895.
Trichina spiralis Owen, 1835.
Trichina circumflexa Polonio, 1860.
Pseudalius trichina Davaine, 1863.
Trichonema (*Cylicostomum*) *aegyptiacum* Railliet, 1923.
Strongylus tetracanthus Mehlis, 1831, *e.p.*
Sclerostoma quadridentatum Dujardin, 1845, *e.p.*
Sclerostomum tetracanthum (Mehlis, 1831) Diesing, 1851, *e.p.*
Cyathostomum tetracanthum (Mehlis, 1831) Molin, 1861, e.p.
Cylichnostomum tetracanthum (Mehlis, 1831) Looss, 1902.
Cylicostomum tetracanthum (Mehlis, 1831) Gedoelst, 1903, *e.p.*
Trichostrongylus axei (Cobbold, 1879) Railliet and Henry, 1909.
Strongylus axei Cobbold, 1879.
Strongylus tenuissimus Mazzanti, 1891.
Strongylus gracilis M'Fadyean, 1896, *nec* Leuckart, 1842.
Strongylus extenuatus Railliet, 1898.
Trichostrongylus extenuatus (Railliet, 1898) Ransom, 1907.
Trichostrongylus capricola Ransom, 1907.
Trichostrongylus colubriformis (Giles, 1892) Ransom, 1911.
Strongylus colubriformis Giles, 1892.
Strongylus instabilis Railliet, 1893.
Strongylus subtilis Looss, 1895.
Trichostrongylus instabilis (Raill., 1893) Looss, 1905.
Trichostrongylus subtilis (Looss, 1895) Looss, 1905.
Trichostrongylus delicatus Hall, 1916.
Trichostrongylus retortaeformis (Zeder, 1800) Looss, 1905.
Strongylus retortaeformis Zeder, 1800.
Trichostrongylus tenuis (Mehlis, 1846) Railliet and Henry, 1909.
Strongylus tenuis Mehlis, 1846 (in Creplin, 1846).
Strongylus serratus Linstow, 1876.
Trichostrongylus vitrinus Looss, 1905.
Trichuris ovis (Abildgaard, 1795) Smith, 1908.
Trichocephalus ovis Abildgaard, 1795.
Trichocephalus affinis Rudolphi, 1802.
Mastigodes affinis (Rud., 1802) Zeder, 1803.
Trichuris affinis (Rud., 1802) Stiles, 1902.
Trichuris trichiura (Linnaeus, 1771) Stiles, 1901.
Ascaris trichiura Linnaeus, 1771.
Trichocephalus hominis Schrank, 1788.
Trichuris suis Schrank, 1788.
Trichocephalus apri Gmelin, 1790.
Trichocephalus dispar Rudolphi, 1802.
Mastigodes apri (Gmelin, 1790) Zeder, 1803.
Trichocephalus crenatus Rudolphi, 1809.
Trichocephalus trichiurus (Linn., 1771) Blanchard, 1895.
Triodontophorus serratus (Looss, 1900) Looss, 1902.
Triodontus serratus Looss, 1900.
Triodontophorus intermedius Sweet, 1909.
Triodontophorus tenuicollis Boulenger, 1916.
Uncinaria stenocephala (Railliet, 1884) Railliet, 1885.
Strongylus criniformis (Goeze) of Rudolphi, 1802.
Dochmius stenocephalus Railliet, 1884.
Uncinaria polaris Looss, 1911.
Dochmoides stenocephala (Raill., 1884) Cameron, 1924.

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Tuberculosis of Sheep in Uganda*

J. CARMICHAEL, D.Sc., M.R.C.V.S., DIP. BACT. (LONDON)

VETERINARY LABORATORY, UGANDA

The Literature.

Tuberculosis in sheep is recognised as being a rare condition, and of the millions of sheep annually slaughtered for food throughout the world it is very exceptional to find lesions of this disease.

The literature on the subject is not extensive. As a matter purely of historical interest, the first mention of tuberculosis in sheep which has come to my notice is a paper by Barton (1867), who reports the *post-mortem* findings on a lamb which had died of "staggers." He states, *inter alia*: "The base of the cerebellum was completely destroyed as were also some portions of the medulla oblongata, the medullary substance being replaced by tubercular cells." This was 15 years before Koch's discovery of the mammalian tubercle bacilli!

Steel (1893) mentions that there is no evidence that true tuberculosis is a disease of ovines. He quotes Dun (1869) who speaks of "scrofulous lung, throat, joints, and osseous disorders in sheep due to hereditary influence as undermining the animal's constitution."

He also states that the only indubitable instance of the disease which had occurred up to that time was a lamb which had been fed on the milk of a tuberculous cow and was reported by Bollinger (1873).

The first authentic case recorded in Great Britain was investigated by M'Fadyean (1900). The material available was the side of a sheep which had been seized in a slaughterhouse in December, 1898.

On the parietal pleura there were clusters of nodules very like those of perlsucht in cattle. Two rabbits were inoculated with caseo-purulent material, and died 130 and 154 days afterwards respectively. Further rabbits were inoculated and a culture obtained from the last rabbit of the series, but this was not further investigated.

A further case was reported by M'Fadyean (1902). The animal was a cross-bred ewe and showed lesions of advanced generalised tuberculosis, with particular localisation in the lungs one of which was to a large extent destroyed and replaced by caseous and partially calcified material. Two guinea-pigs were inoculated with infected material from the lung and liver respectively. One died of generalised tuberculosis in 72, and the other in 77 days. A culture obtained from the lung lesions showed, after three weeks incubation, a large number of short uniformly stained tubercle bacilli, although no acid-fast organisms were detectable on direct examination of the infected material.

The next case was recorded by Fullerton (1902). This sheep, on *post-mortem* examination, showed numerous tubercles in the lungs with extensive consolidation. There were numerous nodules on the pleura, and tubercles were present in the liver, spleen, and both kidneys. A right inguinal gland, the sternal, cervical, mesenteric, lumbar, anterior mediastinal, and dorsal lymphatic glands contained caseating patches. Guinea-pigs were inoculated and on *post-mortem* showed caseation of the regional glands.

No information was given in M'Fadyean's cases or Fullerton's case regarding the cultural characteristics of the organism.

Owing to the pathogenicity to rabbits and the severity of the lesions produced, M'Fadyean's first case was probably bovine. His second case was mammalian, probably bovine; whilst in Fullerton's case no opinion can be expressed except that the disease did not extend beyond the glands adjacent to the site of inoculation, and was therefore only slightly pathogenic to these animals. This is not a characteristic feature of a normal mammalian strain.

Ostertag (1907) points out that whilst tuberculosis is rare in sheep and goats they are susceptible to the disease. This is shown by the occurrence of spontaneous infection, and by inoculation experiments.

He quotes figures for the year 1890 to show that in Saxony the percentage of tuberculous sheep as seen in slaughterhouses was 0·2, whilst for the same year in Berlin the percentage was 0·0048. In Saxony the percentage of tuberculosis in sheep sank from 0·15 in 1894, to 0·07 in 1896, and to 0·06 in 1899. This improvement was considered to be due to the fact that in previous years pseudo-tuberculosis had been confused with the true disease. It is significant to mention, in this connection, that tuberculosis in sheep is scarcely referred to in Young's edition of Ostertag's book (1934).

*Most of the substance matter in this paper was included in a thesis accepted by the University of Edinburgh for the D.Sc. degree in Veterinary Science.

ACANTHOCEPHALA

**Macracanthorhynchus hirudinaceus* (Pallas, 1781) Travassos, 1917.
Taenia hirudinacea Pallas, 1781.
Echinorhynchus gigas Bloch, 1782.
Gigantorhynchus gigas (Bloch, 1782) Hamann, 1892.
Gigantorhynchus hirudinaceus (Pallas, 1781) Railliet, 1893.
Echinorhynchus hirudinaceus (Pallas, 1781) Wolffhügel, 1908.

Wallis Hoare (1913) refers to the rarity of tuberculosis in sheep, and quotes M'Fadyean's and Fullerton's cases (*vide supra*). He refers to a case in sheep recorded by Moussu (no reference given), where the animal had been kept in contact with tuberculous cows for two years.

Mouquet (1918) reported two cases in Barbary wild sheep (*O. tragelaphus*). They were in captivity, and he suggests that infection was of the human type, and might have been carried by a tuberculous keeper or by rats. No evidence is given in support of this opinion, nor was any bacteriological examination carried out.

Griffith (1925) in an excellent paper reviews the British cases reported to that date, and records two cases in sheep in which the avian type of bacillus was responsible for infection. Detailed accounts are given of cultural characteristics and inoculation experiments with weighed amounts of culture. Guinea-pigs, rabbits, fowls, sparrows, sheep and goats, were used in the determination of the type of tubercle bacillus. No case of tuberculosis in sheep had, up to that time, been investigated by a study of a culture with a view to typing the organism.

Edelman, Mohler and Eichhorn (1925) state that sheep are almost immune to tuberculosis, as only seven carcases were found infected in 1922 out of 12,000,000 sheep inspected by the Federal Meat Inspection Services of the United State of America.

The statistics of meat inspection in the German Empire are quoted for 1918, and show that 0·02 per cent. of sheep were tuberculous.

Hutyra and Marek (1926) describe the clinical disease in sheep.

Leighton (1927) gives no reference or figures but states that tuberculosis in the case of sheep and goats occurs in 0·002 per cent. of these animals.

Jowett (1928) records two cases of ovine tuberculosis which he encountered at the Gorgie abattoirs in Edinburgh.

In the first case the lungs were crepitant but contained many nodular lesions and a few solid areas. The nodular lesions showed a fibrous periphery with a fibro-caseous interior, and the majority were about 1 cm., in diameter. An extensive lesion measuring about 15 cm. in length, and 5 cm. broad, extended along the base and the upper border of the right lung. The left lung showed two large fibro-calcareous areas each about the size of a hen's egg, together with numerous smaller nodular lesions scattered throughout the substance of both lungs. The bronchial and mediastinal glands were much enlarged, and about the size of a hen's egg. They were firm in consistence and contained fibro-caseous nodular lesions, some of which were extensively calcareous. The liver contained many nodular fibro-caseous lesions, and the portal lymphatic glands were enlarged and firm, and contained fibro-caseous and calcareous material. Acid-fast organisms were not found on direct examination of the tuberculous material from the lungs and affected glands. Guinea-pigs were inoculated and on *post-mortem* examination showed lesions of generalised tuberculosis. Cultures were obtained which proved to be dysgonic. A rabbit was inoculated with 0·1 mg. of culture intravenously and died 21 days afterwards with lesions of acute miliary tuberculosis of the lungs. The culture was also pathogenic to a guinea-pig in a dose of 0·1 mg. intramuscularly. The organism was evidently of the bovine type.

The second sheep showed lesions only in the liver, the other organs being, it was stated, quite normal. Acid-fast organisms were not found on microscopical examination of the fibro-caseous material from the liver tubercles or from the hepatic gland which was also infected. Cultures were obtained through a guinea-pig inoculated with the sheep material. A dysgonic growth on glycerine media was obtained, and the bovine type of tubercle bacillus confirmed by rabbit inoculation.

Ferwerda (1928) in discussing tuberculosis in sheep states that the lymph glands are always found to be calcified, and advances the hypothesis that the parathyroid glands may be responsible for this, the pastoral existence of the sheep, and the vitamins in the herbage, possibly providing the necessary stimulus for the endocrine activity. There is a notable lack of experimental evidence in support of this hypothesis.

Oppermann (1929) refers to the rarity of tuberculosis in sheep and gives a short account of the aetiology, pathogenesis, pathological anatomy, symptoms and differential diagnosis. He quotes the following figures from Ostertag (1923), showing the incidence of tuberculosis in sheep met with in slaughterhouses in Germany:—

	Year.	Percentage Incidence.
Prussia:	1898	0·11
	1899	0·12
	1910	0·0019
	1911	0·0012
	1912	0·0017
	1923	0·0015
Saxony:	1894	0·07
	1896	0·06
German Empire:	1912	0·14
Also Moscow slaughter-houses (no date):		0·09

He considers that the tubercle bacillus is usually taken in with food, but some other

workers maintain that it may also be contracted by inhalation. Infection occurs mainly in young lambs fed with cow's milk. Reference is given to Koch and Petit's opinion that if older sheep cohabit with tuberculous cattle they can contract the disease.

Other authorities quoted are Reinhart (1921), who considers that generalised tuberculosis is very rare in sheep, whilst Rasmussen (1894) is said to have seen tuberculous nodules in the vertebrae of sheep. Bottcher (1908) is quoted as having recorded tuberculous lesions in the cerebrum and cerebellum of sheep.

Davidov (1930) records a case of spontaneous tuberculosis in a sheep in Russia. The clinical symptoms showed a normal temperature with increased pulse and respirations. The conjunctiva and buccal mucous membranes were slightly cyanosed. The submaxillary glands were indurated and enlarged. There was dullness on percussion of the chest, whilst auscultation revealed nothing of importance. On *post-mortem* examination there were patches of consolidation in the lungs and tuberculous foci were present in the parenchyma. Two miliary tubercles are said to have been found in the wall of the larynx. The mediastinal glands were greatly enlarged and weighed up to 562 grammes. On dissection there was a thick lamellated capsule of connective tissue, inside which was a small strip with flesh-like contents of a saffron colour. There was no calcification. A pure culture of tubercle bacilli is said to have been obtained. No cultural investigations or animal experiments with a view to typing the organism are recorded.

Salvi (1932) in a long paper reviews the literature on tuberculosis in sheep. The detailed references, however, are not given in the original article, but only in the reprints of the paper which I was unable to procure. A certain amount of emphasis is given to the belief that the sheep is resistant to tuberculosis on account of the high degree of calcification which accompanies tuberculous lesions in these animals, and Petit, Mayer, Nieberle and Eber are quoted in support of this observation.

As will be pointed out later, calcification was certainly not a constant feature in all cases of tuberculosis in sheep examined in Uganda, though it was present in some of them.

Salvi (1932) also quoted Myschkin's figures from the Moscow abattoir. He observed two cases, and records that in the year 1897, of 29,478 sheep slaughtered, only 27 or 0·09 per cent. were tuberculous. Salvi in the same paper records a case of tuberculosis in a sheep weighing 18 kilos which was born and reared under semi-wild conditions in the province of Bologna, Italy. The lungs were covered with circumscribed recently formed nodules of various sizes, which were semi-opaque, greyish-white in colour, and raised above the surface. The condition on closer examination proved to be tuberculosis complicated by concurrent verminous broncho-pneumonia. The mediastinal glands were greatly enlarged resembling a long cylinder 2·5 cm. in diameter and were stony in consistency. On section the glands showed evidence of cascating necrosis with advanced calcification. Histological examination confirmed the diagnosis of tuberculosis and acid-fast bacilli were seen in numerous clumps. The spleen was found to be infected, and contained a few round fibrous nodules varying in size between that of a grain of maize and that of a millet seed. Giant cells were more numerous in the spleen than the lungs. Cultures were apparently not prepared or steps taken to ascertain the type of tubercle bacillus present.

Bruijel (1933) records in a short note a case of tuberculosis in a cow, believed to have originated from some sheep which were later tuberculin tested with positive results. No details are given of the tuberculous lesions in the sheep.

Harshfield and Roderick (1934) record six cases of spontaneous tuberculosis in sheep in America all due to the avian type of bacillus. Five of these were generalised infections, whilst one was confined to the lungs and associated lymph glands. Calcification was well advanced in the lesions. Experiments were carried out to determine the susceptibility of sheep to the avian type of tubercle bacillus.

In the case of intravenous inoculation with filtered normal saline emulsion of tuberculous liver and spleen of a chicken infected with a sheep strain, two out of three lambs showed macroscopic lesions when slaughtered. The actual dose of organisms in such an experiment is, of course, a matter of conjecture only. Feeding experiments with tuberculous material infected two out of three lambs, whilst contact experiments with tuberculous fowls resulted in two infections out of 15 sheep. Sensitisation to avian tuberculin of short duration was produced in 20 out of 21 sheep, indicating transitory infections.

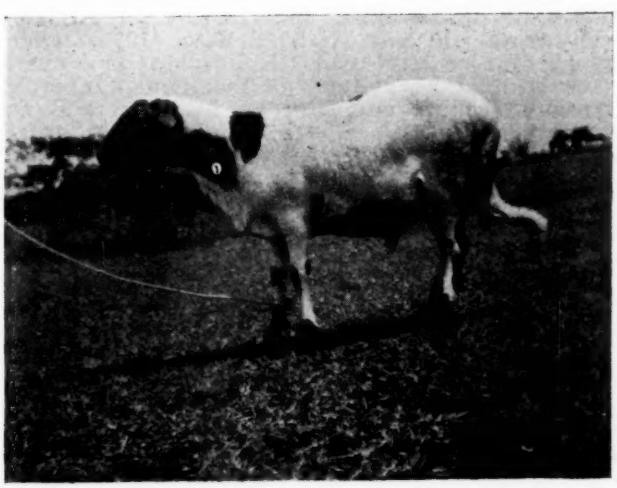
The rarity of the disease in the United States is emphasised by the following table which records the statistics from the Bureau of Animal Husbandry of sheep slaughtered under Federal Inspection:—

Year.	Sheep and Lambs Slaughtered	Retained for Tuberculosis.	Condemned for Tuberculosis.
1928	12,983,841	1	1
1929	13,768,865	1	1
1930	15,306,899	5	5
1931	17,300,432	3	3
1932	18,659,941	5	4
1933	17,283,875	2	2

Murphy (1935) reported what appears to be the first case of tuberculosis in a sheep in Ireland. Lesions were found in the lungs, spleen and mammary glands, whilst numerous lymph glands throughout the body were also infected. Fibrosis and calcification were well advanced, and in spite of the extensive distribution of the disease there was no obvious systemic disturbance, and the carcase was in good condition. An emulsion of the lesions was inoculated into a rabbit and a guinea-pig both of which died, on the 69th and 77th day, respectively, from generalised tuberculosis. The infection was probably bovine, but no cultural characteristics are recorded and the dose of organisms inoculated was not known, thus the method of typing is open to criticism.

OVINE TUBERCULOSIS IN UGANDA

The literature concerning tuberculosis in sheep deals almost entirely with the usual European breeds. The native sheep in Uganda and tropical Africa generally are of the Persian fat-tailed type (*see* photograph). They are not woolled and their coats consist of coarse hair. Sheep are kept by most tribes, although goats are the most popular of the smaller domestic ruminants. They are not generally kept in large flocks. They graze round the villages during the day and share the native huts at night.



The type of sheep in which the cases of tuberculosis occurred.

This animal was positive to the tuberculin-test and showed lesions on *post-mortem* examination.

So far as I can ascertain, there is no record of tuberculosis in the indigenous African sheep and the recent discovery of the disease in Uganda is of considerable interest.

Apart from the purely pathological and bacteriological standpoint the presence of tuberculosis in sheep and goats raises a question of great significance from the public health point of view, as the relation between man and his domestic animals in tropical Africa is of the closest. The sheep and goats, and sometimes cattle, share the same smoke-laden unventilated huts as the native African with his wife and family.

A tuberculous sheep is capable of coughing a droplet infection over the human occupants of the same dwelling, whilst *vice versa* a tuberculous human-being will disseminate infection with the greatest of ease over both his human and animal co-dwellers.

It is quite certain that the African native does not recognise tuberculosis as a disease of sheep, although there is evidence that the disease is not infrequent among these animals.

One of the most striking features regarding many of the cases of tuberculosis encountered in sheep in Uganda, is the apparent absence of any clinical symptoms of the disease, although at autopsy a very advanced pulmonary infection may be found to exist.

The first case of ovine tuberculosis came to my notice in May, 1934, when Mr. Allan, Veterinary Officer, Ankole, reported that a ram in the Government Stock Farm flock at Mbarara had died of what appeared to be generalised tuberculosis. He sent me material for bacteriological examination, and the organism was isolated in pure culture. This case will be dealt with in detail under the heading of "Mbarara Ram Strain." As will be seen from the records, the organism isolated from this case proved of very great interest as it turned out to be of the human type.

Later, a further sheep and two goats from the same flock were reported as having died of tuberculosis. Unfortunately I did not obtain material for bacteriological examination, but acid-fast organisms were present in smears from the caseous matter in the lungs and there seems no doubt that tuberculosis was the cause of death.

At this juncture it was decided to send the entire flock of sheep and goats to the laboratory for investigational purposes. There were 15 sheep and eight goats available, and I was impressed by the very fine condition of all the animals which were excellent specimens of the best type of native sheep and goats. It will be observed that this flock came from Ankole, where bovine tuberculosis is extremely frequent.

Typing of strains from human sources, which will be dealt with in a separate paper, revealed only the human type of organism in this district.

Double intradermal tuberculin tests, using 0·1 c.c. of Burroughs Wellcome's bovine tuberculin, were carried out on the sheep. Out of

the 15 no fewer than nine showed positive reactions. All the positive reactors either died or were slaughtered, and each case will be dealt with in detail when the bacteriological findings in sheep tuberculosis are discussed.

Apart from the tuberculin tests carried out at the laboratory, 15 sheep were tested in Kigezi district and 25 in Ankole, when the writer was testing cattle. No reactors were discovered, but the number of tests is too small to enable one to express an opinion as to the prevalence of the disease in sheep in these areas; although in Ankole the percentage of reacting cattle (long-horned type) was over 76 per cent. whilst in Kigezi (intermediate type) it was only 5 per cent.

Tuberculin tests were also carried out on twelve sheep which were sent to the laboratory from the mountainous Bugishu district. All of these had been housed in huts with cases of human phthisis pulmonalis but none reacted, and at *post-mortem* examination the negative tuberculin test was confirmed by the absence of any tuberculous lesions.

Details of Cases of Tuberculosis in Sheep in Uganda

Case No. 1.

"Mbarara Ram." This sheep was bought from a native by the veterinary officer, Ankole, and was herded with the flock of sheep and goats at the Government Stock Farm at Mbarara. It had been living in the hut of a native, but unfortunately no details of the medical history of the previous owner are obtainable. The ram was in excellent condition, but was noticed by the shepherd to be coughing for about ten days before it was found dead.

Post-mortem Examination.—This revealed advanced tuberculosis of both lungs, which were full of tubercles and contained large cavities full of caseous material. The bronchial and mediastinal glands were enlarged and caseous. There were tubercles in the spleen. No marked signs of emaciation were present, and there was an abundance of omental and perirenal fat. I am indebted to Mr. Allan, M.R.C.V.S., Veterinary Officer, Ankole, for the above history and *post-mortem* findings.

Bacteriological Examination.—A portion of caseous gland was received at the laboratory in an advanced state of putrefaction. It was ground up in a Griffith's tube with N/1.NAOH, which was allowed to act for one hour at 37° C. Two guinea-pigs were inoculated with 1 c.c., of the emulsion, after neutralisation with acid.

One of the guinea-pigs died after 48 hours from septicaemia. The second guinea-pig was killed 47 days later, and showed advanced generalised tuberculosis. Cultures were obtained from the spleen on modified Löwenstein's medium and Dorset egg, both non-glycerinated.

After three weeks' incubation there was a slight flat dry growth. Early subcultures on to glycerinated media showed little or no improvement in growth, but later subcultures gave a much better growth with definite improvement on the glycerinated medium. After the fifth subculture the eugonic character of growth was definitely established.

Animal Inoculations.

Owing to the unexpected eugonic culture obtained from this case a considerable number of animal inoculations were carried out with a view to determining the type of organism present. For the sake of clarity the details are submitted in tabular form. (*See opposite page.*)

Observations on Animal Experiments.—Only actively growing cultures no more than 21 days old were used for inoculations. The dose used in rabbits Nos. 7 and 8 was, of course, grossly excessive for typing purposes and was inoculated merely to test the pathogenicity of the strain.

Goat No. 11: Examination of films prepared from the caseous matter revealed numerous acid-fast organisms up to eight microns in length. They were all showing a beaded appearance, which was probably degenerative, as efforts to obtain cultures were unsuccessful and guinea-pig inoculations with the caseous material did not set up tuberculosis.

Sheep No. 14: Examination of films from the caseous focus in the adjacent gland revealed acid-fast organisms, which on inoculation into a guinea-pig set up tuberculosis, thus proving that the organisms were still viable.

Conclusions.—From cultural characteristics and the results of animal inoculations it would seem that this organism is of the human type.

It is generally accepted that sheep are not susceptible to the human type of the tubercle bacillus, but the number of cases of spontaneous tuberculosis in sheep in which the organism has been studied are extremely few.

Inoculation of this particular strain did not set up the disease in two inoculated sheep, and it would appear that this is a rare case of individual susceptibility.

In this connection it is worthy of note that the human type of bacillus has been isolated from cases of spontaneous tuberculosis in African ruminants. F. and A. S. Griffith (1911) when working for the Royal Commission on Tuberculosis obtained cultures of the human tubercle bacillus from a gnu (*Gorgon taurinus*) and an antelope (*Oryx beisa*). Both animals were extensively infected. Later A. S. Griffith (1928) reported a case of tuberculosis in a blesbok (*Damalisius albiforus*) from which the human type of organism was isolated.

I am deeply indebted to Dr. S. G. Griffith, of Cambridge, for confirming the type of strain in this case.

An Experiment to Test the Susceptibility of Uganda Sheep and Goats to a Human Strain of *Mycobacterium Tuberculosis.*

In view of the above findings the following small experiment was carried out to ascertain if native sheep and goats were normally susceptible to the human type of tubercle bacilli.

One young goat and one young sheep were inoculated with 10 mg. of a 21-day-old culture isolated from a phthisical Muhima, a native of Ankole district. This strain was a typical eugonic human virus, non-pathogenic to rabbits.

Sheep.—This animal died from a heavy infection of *Haemonchus contortus* 51 days later. On autopsy there was no evidence of tuberculosis except a small caseous focus in the adjacent (prescapular) gland. Films from the caseous matter in the mediastinal and bronchial glands, spleen and liver, showed no acid-fast organisms.

Goat.—This animal also died of parasitic gastritis after 59 days. The adjacent (prescapular) gland was enlarged and indurated but showed no caseation. The rest of the carcase

Animal.	Route and Dose.	Killed or Died.	Period of Survival in Days.	Autopsy.
1. Fowl ...	10 mg. I.M.	Killed	43	Healthy.
2. „ ...	2 mg. I.V.	„	43	„
3. Rabbit ...	10 mg. I.M.	„	225	„ no sign of tuberculosis.
4. „ ...	10 mg. I.M.	„	161	Good condition. Creamy purulent regional abscess; two small tubercles in left lung.
5. „ ...	0.01 mg. I.V. 21 days old growth on ox serum.	„	177	Excellent condition. Increase in weight 110 grammes. No tuberculosis.
6. „ ...	0·1 mg. I.V. 21 days old growth on ox serum.	„	177	Excellent condition. Increase in weight 266 grammes. No tuberculosis.
7. „ ...	3 mg. I.V.	„ *in extremis*	46	Greatly emaciated. Miliary tuberculosis of lungs and spleen.
8. „ ...	5 mg. I.V.	„ *in extremis*	76	Emaciated. Numerous tubercles in lungs and kidneys.
9. Guinea-pig	1 mg. S.C.	Died	68	Severe generalised tuberculosis.
10. Young goat	10 mg. S.C.	„	66	No sign of tuberculosis. Death due to the parasitic gastritis (*H. contortus*).
11. „	10 mg. S.C.	Killed	192	Good condition. A small encapsulated abscess in adjacent (prescapular) gland. No other sign of tuberculosis.
12. „	10 mg. S.C.	„	192	Excellent condition. Enlarged prescapular gland but no caseation.
13. Young Sheep	10 mg. S.C.	„	77	Poor condition. Numerous *H. contortus* in abomasum. No sign of tuberculosis.
14. „	10 mg. S.C.	„	77	Fair condition. Adjacent (prescapular) gland enlarged and contained a small focus of yellow caseous pus. Rest of carcase normal.

S.C. = Subcutaneous; I.V. = Intravenous; I.M. = Intramuscular.

was free from tuberculous lesions, and films prepared from the glands, spleen and liver, showed no acid-fast bacteria.

It would seem from this small experiment that individual sheep and goats in Uganda are not susceptible to the human strain of *Mycobacterium tuberculosis*—a result which would be expected, although on one of each species it is impossible to generalise. The experiment is merely recorded.

Case No. 2.

Two-Year-Old Ewe.—This was a ewe about two years old with a lamb at foot near to weaning. It came to the laboratory with the Mbarara flock and was turned out in a paddock with the rest. This case occurred before the tuberculin tests were carried out; it was reported sick on March 2nd. On examination its temperature was 105° F., with rapid and distressed respirations. The mucous membrane showed signs of early cyanosis, and on physical examination of the chest there were signs of consolidation over the whole area of both lungs. There was a slight muco-purulent discharge from both nostrils. The animal was in fair condition. The next morning it was found dead.

Post-mortem Examination.—The macroscopic lesions were confined to the thoracic lymph glands and lungs, the rest of the carcase being normal. The mediastinal glands were greatly enlarged and indurated, measuring about 8 cm. long and 3 cm. broad. On section they were found to be full of fibro-caseous material—hard and firm but showing no calcification.

Lungs: Both lungs were distended. The visceral pleura showed gelatinous exudate tending to become organised, and on the right side, adhering to the chest wall, the pleura was thickened and showed firm finger-like filamentous projections from the surface. On palpation of the lungs there were masses of firm round tubercles, whilst shining through the pleura were numerous masses of caseous material about the size of a sixpenny piece. The anterior lobe of the right lung, anterior lobe of the left lung, and anterior portion of the middle lobe of the left lung, showed diffuse red hepatisation which, on section, showed numerous miliary tubercles.

Long section of the entire right lung showed in

the base a cavity the size of a walnut opening into a large bronchus in which was found a mass of creamy muco-purulent material containing caseous flakes. A few similar lesions were also present in the rest of the lung. Generally the lung tissue was reddish in colour, and very granular, containing numerous small purulent foci. In the anterior lobe of the right lung there was a mass of dry caseous material.

In the left lung a large purulent focus was present in the base, showing distinct tendency to cavity formation, the cavity opening into a large bronchus. The pus was soft and more muco-purulent than caseous. Smaller foci were present in the parenchyma of the base. The muco-purulent material had a tendency to a greenish tinge. The bronchial lymph glands were large, indurated and congested. In certain of the foci the pus was distinctly granular and dry. The presence of cavities and the larger lesions gave an uneven or lumpy appearance to the surface of the lungs.

The peribronchial and peritracheal tissues showed a reddish oedematous appearance. There was also acute-bronchitis and tracheitis with plugs of muco-purulent or muco-caseous material.

Smears from the caseous matter in the lungs and glands showed numerous acid-fast bacilli, whilst the muco-purulent matter in the trachea was swarming with organisms.

Bacteriological Examination.—In addition to the inoculation of rabbits and guinea-pigs, direct cultures were made on to modified Löwenstein's medium and Dorset egg. After six weeks numerous discrete colonies were visible. Sub-cultures on to glycerinated and non-glycerinated media showed a typical dysgonic flat dry ground-glass-like growth. On the glycerine media there was only a very slight film after four weeks' incubation at 37° C.

Animal Inoculations.

Case No. 3.

Sheep No. 6.—This was a very fine specimen of a castrated native ram in excellent condition. It was positive to the tuberculin test in March, and was slaughtered on April 30th.

Post-mortem Examination.—The carcase was fat and in excellent condition. The prescapular glands and the hepatic lymph glands were enlarged and firmer than usual. The liver showed twelve small calcified nodules about the size of a linseed, situated below the capsule; and two larger encapsulated calcified nodules about the size of a pea, in the substance of the organ. There was no sign of fluke infestation, and nodules appeared to be tuberculous in nature.

Acid-fast organisms were not found in smears from these nodules or from the enlarged lymph glands. The rest of the carcase was normal.

Animal Inoculations, etc.—Two guinea-pigs were inoculated with emulsion from the liver tubercles, prepared by grinding them up with a little broth. They were killed 107 days later and were found healthy.

Direct culture also failed and no growth was obtained after three months.

Case No. 4.

Sheep No. 15.—This was a barren ewe in excellent condition. It gave a positive reaction to the tuberculin test. It was slaughtered on May 5th, 1935.

Post-mortem Examination.—The right lung showed a localised pleural adhesion to the thoracic wall. The mediastinal gland was enlarged and indurated and contained a small area of caseo-calcified nodules at the anterior pole.

The retropharyngeal and parotid lymph glands were larger and firmer than normal. In the liver there was one fibrous encapsulated nodule about the size of a pea, and containing yellow caseo-calcareous matter. The rest of the carcase was normal.

Acid-fast organisms could not be demonstrated in films prepared from the caseous material in the mediastinal gland or liver.

Animal.	Route and Dose.	Killed or Died.	Period of Survival in Days.	Autopsy.
1. Rabbit ...	1 c.c. emulsion of caseous material I.M.	Died	99	Severe local lesion. Lungs, mass of tubercles; kidneys full of raised tubercles.
2. „ ...	1 c.c. emulsion of caseous material I.M.	„	95	Severe local lesions. Lungs, mass of tubercles; kidneys, raised tubercles; spleen, few tubercles.
3. Guinea-pig	1 c.c. emulsion of caseous material S.C.	„	95	Acute generalised tuberculosis.
4. Rabbit ...	0·01 mg. I.V.	„	79	Severe generalised tuberculosis. Raised tubercles on kidneys.
5. „ ...	0·1 mg. I.V.	„	38	Acute generalised miliary tuberculosis.
6. „ ...	2 mg. I.M.	„	59	Severe generalised tuberculosis. Loss in weight 775 grammes.

S.C. = Subcutaneous; I.V. = Intravenous; I.M. = Intramuscular.

Conclusion.—This appears to be a typical dysgonic bovine strain of normal virulence. The period of survival in rabbit No. 4, *viz.*, 79 days, is difficult to account for, but the remaining inoculations amply demonstrate normal pathogenicity.

Bacteriological Examination.—A typical dysgonic culture was obtained which showed no improvement on glycerinated media.

Animal Inoculations.

(1) Guinea-pig inoculated subcutaneously with 0·5 c.c. of an emulsion of the caseous material died of generalised tuberculosis 107 days later.

(2) Guinea-pig inoculated subcutaneously with 0·5 c.c. of an emulsion of the caseous material died 130 days later from generalised tuberculosis.

(3) Guinea-pig inoculated subcutaneously with 1 mg. of culture died 53 days later from generalised tuberculosis.

(4) Rabbit inoculated intramuscularly with 10 mg. of culture died 40 days later. *Post-mortem* examination showed severe tuberculosis of the lungs, spleen and kidneys.

(5) Rabbit inoculated with 0·01 mg. intravenously died of generalised miliary tuberculosis 21 days later.

(6) Rabbit (1260 gm.) inoculated intravenously with 0·001 mg. died after 24 days. Autopsy showed generalised miliary tuberculosis (carried out in Dr. S. G. Griffith's Laboratory, Cambridge).

Conclusion.—This organism fulfils all the criteria of a normal dysgonic bovine strain of standard virulence.

Case No. 5.

Sheep No. 816.—This was slaughtered for food at the Mbarara abattoir. It was in good condition and the mediastinal glands were enlarged and full of caseous material. The rest of the carcase was normal. I am indebted to Mr. W. L. S. Mackintosh, Veterinary Officer, Mbarara, for this examination.

Bacteriological Examination.—A piece of caseous gland was received in an advanced stage of putrefaction. Smears revealed numerous acid-fast bacteria. Direct cultures were obtained, and these proved to be dysgonic in character and not improved by the addition of glycerine to the medium.

Animal Inoculations.

(1) Rabbit inoculated intravenously with 0·01 mg. of a 21 days-old culture died 37 days later from acute generalised miliary tuberculosis.

(2) Guinea-pig received 1 c.c. of an emulsion of caseous material subcutaneously. It was killed after 99 days. Autopsy revealed numerous tubercles in the lungs. The spleen was a mass of tuberculous tissue, and the lymph glands all enlarged and caseous.

(3) Guinea-pig inoculated subcutaneously with 1 c.c. of caseous emulsion was killed 99 days later. Autopsy revealed advanced generalised tuberculosis.

Conclusion.—A bovine strain of standard virulence.

Case No. 6.

Sheep No. 8.—A ewe about four years old. This sheep was positive to the tuberculin test in March, and was slaughtered in August. It was reported as coughing severely for several days before it was killed.

Post-mortem Examination.—Lungs: both distended and consisting of innumerable confluent tuberculous abscesses containing greenish-yellow pus, and varying in size up to that of a walnut. The larger abscesses at the base of the lung were tending to cavity formation.

Glands: Mediastinal—enormously enlarged, about 10 cm. by 3 cm., indurated, and consisting of a mass of tuberculous tissue tending to calcification. Mesenteric—all enlarged and some showing small caseous tubercles. Prescapular and precrural—enlarged but not caseous.

Kidneys: Three tubercles about 2 mm. diameter in anterior pole of left kidney, and two tubercles in anterior pole of right kidney.

Mammary gland normal.

Films from lungs and caseous glands showed numerous acid-fast organisms; kidney and liver negative.

Bacteriological Examination.—Cultures were obtained directly from the caseous material of the lung. After three weeks' incubation a flat dry ground-glass-like growth was obtained. Subcultures on glycerinated media were dysgonic in nature, but not so marked as a normal strain. In some tubes the growth appeared slightly more profuse, but the difference was not marked.

Animal Inoculations.

(1) Guinea-pig inoculated subcutaneously with 1 c.c. of caseous emulsion died 39 days later from generalised tuberculosis.

(2) Rabbit received 0·01 mg. of culture intravenously died after 22 days from acute generalised miliary tuberculosis.

Conclusion.—A bovine strain of standard virulence.

Case No. 7.

Sheep No. 10.—A ewe positive to the tuberculin test in April. Killed for examination on August 26th, 1935. It aborted during the night of August 24th, 1935.

Post-mortem Examination.—Liver: small caseous area about 4 mm. square in the right lobe. Hepatic gland indurated but no caseation.

Lungs: Fibrous pleural adhesions over anterior lobe of left lung. Right lung: Four small tubercles 2 mm. in diameter in the central lobe. Base of left lung showed two prominent circumscribed tubercles about the size of a walnut, and containing dry caseous material. Rest of lungs normal.

Mediastinal gland enlarged and indurated, about 8 cm.×1·5 cm., and containing numerous calcified foci. There was also septic metritis and destruction of several cotyledons by necrosis.

Films from lung lesions showed acid-fast bacilli rare. Uterus and mediastinal gland negative.

Bacteriological Examination.—A typical dysgonic growth not improved by the addition of glycerine to the medium.

Animal Inoculations.

(1) Two guinea-pigs inoculated with caseous material from the lungs, subcutaneously, died after 54 and 98 days respectively from generalised tuberculosis.

(2) Rabbit inoculated intravenously with 0·01 mg. of a 21 day old culture died after 41 days of generalised miliary tuberculosis.

Conclusion.—A bovine strain of normal virulence.

Case No. 8.

Sheep No. 14.—A ewe positive to the tuberculin test in April. Killed for examination September 23rd, 1935.

Post-mortem Examination.—Excellent condition and carcase quite normal except for the liver, which showed a small group of partially calcified yellow tubercles on the diaphragmatic surface of the organ, and two small calcified tubercles about 2 mm. in diameter on the visceral surface of the organ.

Bacteriological Examination.—Cultures from the liver lesions were obtained, and were dysgonic and not improved on glycerine media.

Animal Inoculations.

(1) Guinea-pig inoculated with 0·5 c.c. of caseous material subcutaneously, was killed after 75 days. Autopsy showed advanced generalised tuberculosis.

(2) Rabbit inoculated intravenously with 0·01 mg. of culture died after 45 days from generalised miliary tuberculosis.

Conclusion.—A normal dysgonic bovine strain of standard virulence.

Case No. 9.

Sheep No. 1.—This sheep came from Mbarara stock farm, and was positive to the tuberculin test. It was destroyed for examination on September 20th, 1935.

Post-mortem Examination.—Condition excellent. Mediastinal lymph gland enlarged and indurated, about 6 cm.×1·5 cm. and full of yellow dry caseo-calcareous matter. Calcification well advanced.

Acid-fast organisms absent on direct examination of smears.

Liver: One small calcified foetus about 2 mm. in diameter. Portal glands enlarged and indurated but no caseation. Was carrying a foetus nearly to term. Retromammary lymphatics enlarged and indurated but no caseation. Guinea-pig inoculation and cultures taken.

Bacteriological Examination.—A dysgonic growth not improved by glycerine media.

Animal Inoculations.

(1) Guinea-pig inoculated with 0·5 c.c. of caseous emulsion subcutaneously was killed after 108 days. Autopsy showed advanced generalised tuberculosis.

(2) Rabbit inoculated intravenously with 0·01 mg. of culture died after 66 days. Autopsy showed severe tuberculosis of lungs and spleen.

Conclusion.—A dysgonic bovine culture of lower virulence than normal for the one rabbit inoculated.

Case No. 10.

Sheep No. 12.—*Ex* Mbarara stock farm. Age five years. Positive to the tuberculin test. Destroyed for examination.

Post-mortem Examination.—Condition excellent. Left lung contained in its substance six small calcified tubercles about the size of rice grains. The right lung contained one tubercle about 1 cm. in diameter, near the ventral periphery of the intermediate lobe, containing dry yellow caseo-calcareous matter. In the lung substance there were twelve small calcified tubercles about the size of rice grains, and two tubercles about 2 mm. in diameter. Mediastinal gland enlarged and indurated, about 5 cm.×1 cm. and contained caseo-calcareous matter.

Acid-fast organisms rare in smears.

Bacteriological Examination.—A typical dysgonic growth not improved by the addition of glycerine to the medium.

Animal Inoculations.

(1) Guinea-pig inoculated subcutaneously with 1 c.c. of caseous emulsion died 110 days later from generalised tuberculosis.

(2) Rabbit inoculated intravenously with 0·01 mg. of culture died after 43 days of severe generalised miliary tuberculosis.

Conclusion.—A bovine strain of normal virulence.

Case No. 11.

Sheep No. 4.—*Ex* Mbarara stock farm flock. Positive to the tuberculin test. Destroyed for examination on September 20th, 1935.

Post-mortem Examination.—Excellent condition. Small very firm advanced fluke cirrhosis. Portal lymphatic glands enlarged and indurated, and each containing one small calcified focus each about the size of a wheat grain. Left lung contained one tubercle about the size of a walnut, and full of dry yellow caseous material. Right lung normal. Mediastinal gland enlarged, 7 cm. × 1 cm., and indurated, and containing several foci of caseo-calcareous matter.

Acid-fast organisms rare in lung tubercle; absent in mediastinal and portal glands.

Retromammary glands indurated and enlarged but no caseation.

Animal Inoculations.

(1) Guinea-pig inoculated subcutaneously with 1 c.c. of suspension of caseous material died from generalised tuberculosis 119 days later.

(2) Rabbit inoculated intravenously with 0·01 mg. of culture died after 68 days. Autopsy showed severe tuberculosis of lungs and spleen.

(3) Rabbit (1300 gm.) inoculated intravenously with 0·001 mg. died after 38 days. Autopsy showed severe generalised miliary tuberculosis (carried out at Dr. S. G. Griffith's Laboratory, Cambridge).

Conclusion.—A dysgonic bovine strain of standard virulence.

Case No. 12.

Sheep No. 13.—*Ex* Mbarara. Positive to the tuberculin test in March. Slaughtered on November 20th, 1935.

Post-mortem Examination.—Fair condition. One small encapsulated tubercle about the size of a pea in the substance of the right lung containing caseo-calcareous material. Mediastinal gland enlarged and indurated and containing a small caseo-calcareous focus.

Bacteriological Examination.—Acid-fast organisms rare in lung lesion. A typical dysgonic culture was obtained from the tubercle in the lung.

Animal Inoculations.

(1) Two guinea-pigs were inoculated subcutaneously with 0·5 c.c. of caseous emulsion and killed after 74 days. Autopsy showed severe generalised tuberculosis.

(2) Rabbit inoculated intravenously with 0·01 mg. of culture died 45 days later from severe generalised miliary tuberculosis.

Conclusion.—A dysgonic bovine strain of standard virulence.

SUMMARY

(1) The literature on tuberculosis in sheep is reviewed.

(2) The subject of tuberculosis in sheep in Uganda is discussed.

(3) Details are given of twelve cases of tuberculosis in sheep in Uganda, eleven of which were caused by the bovine, and one by the human type of bacillus.

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The experimental scheme for the insurance of livestock conveyed by passenger train or other similar service and/or railway-owned vehicles used for the transport of passenger-rated livestock, introduced in July, 1935, has been renewed by the railway companies of Great Britain for a further twelve months. Under this scheme the senders of livestock may insure their animals against death or injury during transit by the prepayment of small premiums.

Tuberculosis of Goats in Uganda*

J. CARMICHAEL,

VETERINARY LABORATORY, UGANDA

The Literature

Spontaneous tuberculosis in goats is only occasionally met with either as a clinical entity or during the course of meat inspection.

Thompson (1904) recorded in Saxony in the year 1894, out of 1,562 goats slaughtered 0·64 per cent. were tuberculous; and in Prussia in 1899, out of 47,705 goats slaughtered 0·41 per cent. were tuberculous. In the United States of America, Melvin (1908) recorded that only one goat out of 46,000 slaughtered under Government supervision was found to be tuberculous. It has been shown by Griffith (1907) that the goat is highly susceptible to inoculation with the bovine organism, even more so than the calf.

Koch (1884) described a case of spontaneous tuberculosis in a goat. Both lungs contained large cavities whilst extensive lesions were present in the spleen and liver. The bronchial glands were greatly enlarged and caseous.

Sluys and Korevaar (1891) reported a case of tuberculosis in a goat which had been brought up on cow's milk. On *post-mortem* examination there were lesions of generalised tuberculosis. Infection was considered to have been by the alimentary route because the lesions in the intestines, mesenteric glands and liver, seemed to be older than those in the other organs.

The first authentic case of tuberculosis in a goat in Great Britain was reported by Edgar (1892). He sent enlarged bronchial glands and tuberculous lungs to M'Fadyean (1892) who confirmed the diagnosis by histological examination. Giant cells and tubercle bacilli were present in sections prepared from the lung tissue.

Bulling (1896) described a case of tuberculosis in a six year-old goat. The animal was slaughtered and at *post-mortem* examination both lungs were adherent to the thoracic pleura. Many small tubercles were found in the lung tissue. Except for an occasional cough the goat showed no symptoms, and was killed on account of poor lactation after having given birth to a healthy kid. Eight other in-contact goats remained free from the disease.

*Most of the substance matter of this paper was included in a thesis accepted by the University of Edinburgh for the D.Sc. degree in Veterinary Science.

Griffith (1917) recorded a case of spontaneous tuberculosis in a goat. It had been reared on cow's milk, and was found to react positively to tuberculin. It was slaughtered and *post-mortem* examination revealed a caseo-calcareous condition of the left bronchial and mediastinal glands. About a dozen tubercles were present in each lung. A circular ulcer was found in a Peyer's patch of the small intestines, and the gland draining this was tuberculous. The pharyngeal gland and spleen each contained a calcareo-caseous tubercle. The organism was isolated and proved to be a typical dysgonic bovine type. This appears to be the first case of tuberculosis in goats in which the character of the causal organism has been determined.

Golden (1921) reported tuberculosis in a herd of goats imported into America from Switzerland. Apparently two died from the disease, and tuberculin tests revealed six positive reactors out of 42. These reactors were killed and caseo-calcareous lesions were found mainly in the thoracic lymph glands and lungs, but the spleen and liver were affected in two cases. The type of tubercle bacillus was not determined but the diagnosis was confirmed by Murray (1921) using guinea-pig inoculations.

Little (1924) reported the case of a goat which had shown symptoms of coughing and wasting. It was destroyed *in extremis*, and on *post-mortem* examination the lungs, bronchial glands, mediastinal glands and spleen were found to be affected. The diagnosis was confirmed by microscopical examination and guinea-pig inoculation, but the cultural characteristics of the organism and virulence tests were not studied.

Giescu (1924) reported a case of generalised tuberculosis in a six-year-old goat at Cologne abattoir which had shown no symptoms during life although *post-mortem* examination showed lesions in the lungs, thoracic lymph glands, liver and kidneys.

Hutyra and Marek (1926) gave a very short account of the clinical manifestations of the disease in goats, and Schroder and Nocard are quoted as having seen the mammary gland affected.

Griffith (1927 and 1931) recorded a chronic infection in the udder of goats experimentally infected with the avian type of tubercle bacillus. In the first report two goats which were inoculated subcutaneously with avian bacilli showed organisms in their milk 320 days and 20 months later, respectively.

The second goat was the subject of a further report (1931). It had produced kids during the interval, and tubercle bacilli were still being excreted five years later. Further it was shown that kids are resistant to small doses of avian bacilli in the milk taken by the mouth. After five years there was no evidence of a progressive lesion or of destruction of the mammary gland tissue.

Fourie (1928) described a case of tuberculosis in a goat in South Africa, which appears to have been the first and only case reported from the Union or, in fact, from any part of Africa. This animal was in a paddock near some tuberculous cattle and probably became infected from them. It apparently showed no clinical symptoms although on *post-mortem* examination there were extensive lesions in the lungs, whilst the pharyngeal, bronchial and mediastinal glands were also affected. Cavities were present in the lung. The causal organism was of the bovine type.

In Uganda several analogous cases have been seen where there were no clinical symptoms of the disease but extensive lesions on *post-mortem* examination.

Iyer (1932) found six cases of tuberculosis in goats out of a total of 943 examined. This appears to be the first recorded instance of the disease in Indian goats. The organism appears to have been of the bovine type, but the test dose used by him is open to very serious criticism. He inoculated rabbits with 5 mgm. of culture intravenously, which would almost certainly prove fatal whether human, bovine or avian bacilli were injected. The amount inoculated was five hundred times the recognised differentiating dose.

Schwabacher (1934) reported a case of spontaneous tuberculosis in a goat 15 months old. The main lesions were found in the right lung, the whole of which was extensively diseased. Cavities containing soft caseous matter were present in the apical and diaphragmatic lobes. The organism was isolated in pure culture and proved to be a typical dysgonic bovine strain of standard virulence.

Bishop, Barnes and Reidy (1934) in America, reported a case of spontaneous tuberculosis in a goat. The animal had access to cattle which were being tested for tuberculosis under the accredited herd plan, and it appeared that its presence was the cause of positive reactors. The goat sickened and was found dead. *Post-mortem* examination revealed extensive lesions of tuberculosis in the liver, mesenteric lymph glands and lungs. Apparently cultures were not obtained, but rabbits and guinea-pigs were inoculated with emulsions from the lesions and died of generalised tuberculosis. The strain was in all probability bovine, though the method of typing is open to criticism as known doses of organisms were not used for the test inoculations of rabbits.

Recently Begley (1938) reported a case of tuberculosis in a goat slaughtered at the city abattoir Londonderry. This appears to be the first published record of the occurrence of

tuberculosis in a goat in Ireland. On *post-mortem* examination the animal was found to be extensively infected although it was in fairly good condition. Both lungs, mediastinal, bronchial, suprasternal and pharyngeal lymphatic glands showed tuberculous lesions whilst the liver and hepatic gland were also affected. Tubercle bacilli were demonstrated in smears from the lesions but the organism does not appear to have been cultured or typed.

CAPRINE TUBERCULOSIS IN UGANDA

As far as tropical Africa is concerned there appears to be no record of tuberculosis among the indigenous goats. The goat appears to be the one animal in tropical Africa which rarely suffers from any disease. In Eastern Africa the goat is ubiquitous in its distribution and these animals are to be seen near any native dwelling. They are either tethered to the grass near the huts or taken outside the village by the children to graze. The meat is greatly relished, whilst the skins are used for the making of drums or for clothing.

Since these investigations commenced there is evidence that caprine tuberculosis is far from uncommon in this country.

From the public health point of view, the close contact between these animals and human beings is of great importance. The goats share the huts with the owner and his family, and tuberculosis may quite possibly exist in both the human and animal occupants.

The first case occurred at the Stock Farm at Mbarara during January, 1936, but unfortunately no material was available for bacteriological examination. The Veterinary Officer reports that a billy goat died from pulmonary tuberculosis, but no details of the autopsy or history of the case could be obtained. Acid fast organisms were numerous in smears from the caseous material in the lungs. The entire herd of eight goats were sent to the laboratory for further investigation. The double intradermal test was carried out and the readings and results are tabulated below. All the positive reactors either died or were slaughtered, and the findings will be considered in detail under the individual case records.

Whilst carrying out tuberculin tests in Ankole District I took the opportunity of testing 25 goats by the usual double intradermal method. These animals were picked out at random from around the centre in which I was working and belonged to various natives, represented by four different owners. They browsed round the huts during the day in charge of the children, and were put in the

Table Showing Results of Double Intradermal Tuberculin Tests on Goats from Mbarara Stock Farm

Animal Number.	Measurements of Skin in mm.				Remarks.
	Original.	24 hours.	48 hours.	72 hours.	
Goat No. 1					
Control :—	4·4	6·0	4·9	6·5	Hot and painful. Positive.
Tuberculin	4·4	10·4	10·0	30·5	
Goat No. 2					
Control :—	3·9	5·0	—	—	Discontinued owing to pregnancy.
Tuberculin	3·9	10·0	—	—	
Goat No. 3					
Control :—	3·0	4·0	3·5	4·6	Diffuse.
Tuberculin	3·3	12·8	15·4	19·3	Positive.
Goat No. 4					
Control :—	4·3	4·5	3·7	6·0	
Tuberculin	3·5	6·0	5·0	6·5	Negative.
Goat No. 5					
Control :—	3·5	4·6	4·0	4·5	Hot and diffuse.
Tuberculin	3·5	12·8	10·0	19·0	Positive.
Goat No. 6					
Control :—	3·5	4·4	4·5	5·0	Hot and diffuse.
Tuberculin	3·5	7·0	12·4	27·4	Positive.
Goat No. 7					
Control :—	4·2	5·5	4·5	6·7	Hot and painful.
Tuberculin	4·4	16·3	16·0	25·6	Killed, Positive.
Goat No. 8					
Control :—	3·5	4·4	3·0	5·0	
Tuberculin	3·5	5·0	3·3	6·0	Negative.

huts with the owner and his family at night. They all appeared healthy and were typical specimens of the native goats in that area. Of the 25, two were found to give a positive reaction. These were bought after considerable trouble from their owner and slaughtered. In both cases autopsy revealed a very advanced tuberculosis of both lungs involving the thoracic lymph glands. These cases will be considered in detail under the individual case records.

Here we have two apparently healthy goats which were in an advanced state of pulmonary tuberculosis living in the same hut as human beings.

To have discovered two tuberculous goats in the first 25 tested, without any selection of any kind, seems to indicate that in Ankole District, at any rate, caprine tuberculosis must be far from rare.

On the same journey 30 goats were tested in Kigezi District with no reactors. Here the cattle are of the intermediate type and tuberculosis is uncommon, whilst in Ankole bovine tuberculosis is very frequent.

There appears to be a definite relation between tuberculosis in cattle and goats and, as will be seen, the prevailing organism isolated from tuberculous goats is bovine in type.

Details of Cases of Tuberculosis in Goats in Uganda

Case No. 1.

Goat No. 7.—This was a nine-months-old male goat in excellent condition. It was positive to the tuberculin test in April, and was slaughtered three days later.

Post-mortem Examination.—The mediastinal glands were enlarged and indurated and contained yellow caseous material with calcification well advanced. The left lung showed one small tubercle in the intermediate lobe about the size of a pea and containing thick creamy purulent material. Acid-fast organisms were present but not numerous. The right lung showed a rather large tubercle about the size of a hazel-nut containing thick creamy pus and acid-fast organisms rare.

Bacteriological Examination.—Direct cultures from the purulent matter showed, after six weeks, a very poor growth consisting of a thin dry film. Sub-cultures on glycerinated media showed no improvement. The growth was typically a dysgonic one.

Animal Inoculations.

(1) Three guinea-pigs inoculated with an emulsion of purulent material from the lungs died 69, 101 and 113 days later respectively. *Post-mortem* examination revealed acute generalised tuberculosis in each case.

(2) Rabbit received 0·01 mg., culture intravenously died 36 days later from generalised miliary tuberculosis.

(3) Rabbit received 0·1 mg., culture intravenously died 33 days later from generalised miliary tuberculosis.

Conclusion.—Bovine strain of standard virulence.

Case No. 2.

Goat No. 1.—A castrated male in excellent condition. Positive to the tuberculin test in April, and slaughtered May 3rd, 1935.

Post-mortem Examination.—The only lesions of tuberculosis were found in the mediastinal glands and right lung. The former were enlarged and indurated and full of caseo-calcareous matter whilst the lung showed one encapsulated tubercle the size of a large pea containing dry caseous matter, and a smaller tubercle also caseous. Acid-fast bacilli were absent in the mediastinal gland and very rare in the lung lesions.

Bacteriological Examination.—A typical dysgonic growth was obtained by direct culture from the nodule in the lung. The culture on glycerinated medium was extremely poor.

Animal Inoculations (*See below*).

Conclusion.—A dysgonic bovine strain of standard virulence.

Case No. 3.

"Kigungu" Goat.—This was an ordinary male goat bought near Entebbe in December, 1934. It was kept with the healthy goat herd in an area of the laboratory farm where no case

Animal Inoculations (*Case No.* 2).

Animal.	Route and Dose.	Killed or Died.	Period of Survival in Days.	Autopsy.
1. Guinea-pig	0·5 c.c. caseous emulsion S.C.	Died	109	Generalised tuberculosis.
2. „	„ „	„	111	„ „
3. Rabbit	„ „	Killed	153	Small collection of tubercles at site of inoculation. A few tubercles in lungs and on parietal pleurae. Two raised tubercles in left kidney.
4. „	0·01 mg. culture I.V.	Died	23	Generalised miliary tuberculosis. Loss in weight 430 gm.
5. „	„ „	„	24	Generalised miliary tuberculosis. Loss in weight 570 gm.

S.C. = Subcutaneous; I.V. = Intravenous.

of tuberculosis had occurred. It was found dead on May 9th, 1935.

Post-mortem Examination.—The carcase was emaciated and there was evidence of advanced tuberculosis.

Left lung: On superficial examination there was a mottled appearance due to scattered firm abscesses up to the size of a walnut, greyish in colour, and surrounded by a reddish-purple consolidated area showing through the visceral pleura. On section these nodules were seen to be composed of dryish yellow lardaceous caseous material. These abscesses were scattered throughout the substance of the lung.

Right lung: The anterior and cardiac lobes were very similar in appearance to the left lung. The main lobe was entirely excavated by a large abscess which contained a curdled yellow milk-like fluid, though near the walls of the abscess the liquid was more inspissated and flaky. The remains of broken down lung tissue and branches of bronchi were found projecting from the wall of the cavity. None of the lesions showed any tendency to calcification.

Bronchial and Mediastinal glands: Greatly enlarged and surrounded by a gelatinous oedema and showed several large soft caseous centres. Calcifications not apparent.

Spleen: Showed one large nodule about the size of a walnut near the hilus, and projecting about 5 mm., above the surface of the organ.

Microscopical examination of caseous matter in the glands and lungs and abscess fluid revealed numerous acid-alcohol-fast organisms about 2 to 3 μ long.

Bacteriological Examination.—A culture was obtained directly from the caseous matter of the lung lesions by the usual technique. On sub-culturing on glycerinated and non-glycerinated media a good flat dry growth, with a ground-glass-like surface, was obtained on the plain medium, whilst on the glycerinated medium no growth was at first obtainable. Later sub-cultures showed a very slight growth on glycerine medium after four weeks' incubation.

Conclusion.—A dysgonic bovine strain slightly below standard virulence for rabbits.

Case No. 4.

Goat No. 6.—This was a female goat brought from Mbarara. It reacted to the tuberculin test in April. On July 16th, 1935, it was reported sick. Clinical examination showed a temperature of 105° F. Pulse very rapid and thready, coat staring. Palpation of the lungs revealed scattered areas of dullness with hyper-resonance in places. Auscultation showed marked bronchial râles. Breathing was very rapid with signs of dyspnoea, whilst the mucous membranes were cyanotic. On July 17th, 1935, the animal was obviously dying and was destroyed.

Post-mortem Examination.—The animal was in poor condition but by no means emaciated. On opening the thorax the left lung showed marked congestion of the anterior lobe, which on cutting revealed a mass of caseous tuberculous substance intersected by interstitial tissue. The posterior lobe showed no general congestion, but contained numerous tubercles scattered throughout the parenchyma varying in size from a few mm. to 1 cm., in diameter.

There was a small localised patch of fibrinous pleurisy adhering to the chest wall. The mediastinal glands were enormously enlarged, 10×4 cm., and consisted of a mass of dry caseous material with commencing calcification. The bronchial glands were similarly enlarged and caseous and about 4 cm. in diameter.

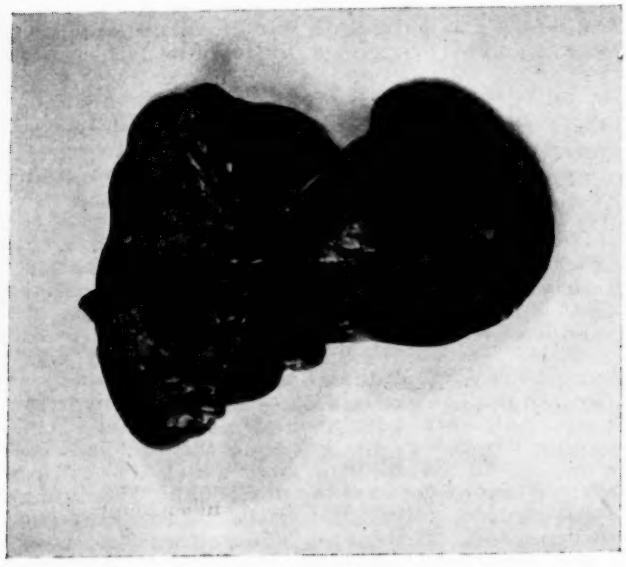
The right lung showed on the pleura a large patch, 20×15 cm., of localised pleurisy with adhesions to the chest wall. There were numerous tubercles showing through the pleura. On section there was marked hyperaemia and three large cavities full of soft caseous matter mixed with mucus and communicating with the main bronchus. The caseous matter was greenish-yellow in colour.

Spleen: On palpation revealed about a dozen firm tubercles scattered throughout the substance of the organ. The tubercles were about the size of a small pea, and contained dry caseous material.

Animal Inoculations (*Case No.* 3).

Animal.	Route and Dose.	Killed or Died.	Period of Survival in Days.	Autopsy.
1. Guinea-pig	0·5 c.c. caseous emulsion S.C.	Died	37	Generalised tuberculosis.
2. ,,	,, ,,	,,	74	,, ,,
3. Rabbit	1 c.c. caseous emulsion I.M.	,,	109	Severe tuberculosis of lungs and raised tubercles on kidneys.
4. Guinea-pig	1 mg. culture S.C.	,,	58	Generalised tuberculosis.
5. Rabbit	10 mg. culture I.M.	,,	94	Very emaciated. Loss in weight 604 grammes. Large abscess at site of inoculation. Severe tuberculosis of lungs. Raised tubercles in kidneys.
6. ,,	0·01 mg. culture I.V.	,,	43	Severe generalised miliary tuberculosis.

S.C. = Subcutaneous; I.M. = Intramuscular; I.V = Intravenous.



Goat Tuberculosis.
Case No. 4 showing lesions in the liver.

Liver: Was small and firm and full of scattered agglomerates of caseous tubercles, some of which were tending to calcify (*see* Fig.). The hepatic glands were greatly enlarged and consisted of a mass of dry caseous material. They were 3 to 4 cm. in diameter. The mesenteric glands were all greatly enlarged, and consisted of dry caseous material which in some cases showed early calcification.

The mammary gland was not lactating and showed no tuberculous lesions. The retro-mammary gland was indurated and enlarged but showed no caseation. The retropharyngeal glands were enlarged and contained several firm tubercles. The rest of the glands were normal. The heart was small and the myocardium showed signs of atrophy, and was pale and flabby.

Microscopical examination of the caseous matter from the lungs showed rare acid-fast bacilli.

Bacteriological Examination.—The organism was isolated directly from the caseous matter in the lung and proved to be a typical dysgonic strain. The growth on glycerinated medium was extremely poor.

Animal Inoculations (*See below*).

Conclusion.—A normal dysgonic bovine strain of standard virulence.

Case No. 5.

Goat No. 5.—From Mbarara. Positive to the tuberculin test in April. Killed for examination July 17th, 1935.

Post-mortem Examination.—Excellent condition. Mediastinal gland enlarged and on section showed a mass about 3×1 cm. of dry caseous matter with commencing calcification. In the left lung near the periphery (ventral edge), there were a few firm caseous nodules. Left retro-pharyngeal gland showed one caseous tubercle. Rest of the carcase normal.

Microscopical examination of caseous matter showed no acid-fast organisms. Two guinea-pigs inoculated and cultures made.

Bacteriological Examination.—A single colony was obtained by direct cultural methods, which on glycerinated and non-glycerinated media gave a typical dysgonic growth.

Animal Inoculations (*See below*).

Conclusion.—A typical dysgonic bovine strain. The survival period for this rabbit is rather longer than normal.

Animal Inoculations (*Case No.* 4).

Animal.	Route and Dose.	Killed or Died.	Period of Survival in Days.	Autopsy.
1. Guinea-pig	1 c.c. of caseous emulsion S.C.	Died	78	Generalised tuberculosis.
2. „	„ „	„	103	„ „
3. Rabbit	0·01 mg. culture I.V.	„	28	Acute generalised miliary tuberculosis.

S.C. = Subcutaneous; I.V. = Intravenous.

Animal Inoculations (*Case No.* 5).

Animal.	Route and Dose.	Killed or Died.	Period of Survival in Days.	Autopsy.
1. Guinea-pig	1 c.c. emulsion of caseous gland S.C.	Died	117	Generalised tuberculosis.
2. „	1 c.c. emulsion of caseous material S.C.	„	139	„ „
3. Rabbit	0·01 mg. culture I.V.	„	54	Severe generalised miliary tuberculosis.

S.C. = Subcutaneous; I.V. = Intravenous.

Case No. 6.

Goat No. 3.—Positive to the tuberculin test in April. Killed for examination on July 18th, 1935.

Post-mortem Examination.—Female in excellent condition. The only lesion was in the mediastinal gland which was enlarged and on section showed a mass of dry caseous matter. Calcification had not commenced.

Acid-fast organisms rare. Two guinea-pigs inoculated and cultures made.

Bacteriological Examination.—A typical dysgonic strain was isolated from the caseous matter of the mediastinal gland.

Animal Inoculations (Case No. 6).

Animal.	Route and Dose.	Killed or Died.	Period of Survival in Days.	Autopsy.
1. Guinea-pig	1 c.c. emulsion of caseous material S.C.	Killed	66	Adjacent glands and spleen tuberculous.
2. „	„ „	Died	87	Generalised tuberculosis.
3. Rabbit	0·01 mg. culture I.V.	„	39	Severe generalised miliary tuberculosis.
4. „	0·001 mg. culture I.V.	„	19	Severe generalised miliary tuberculosis. (Carried out at Dr. S. G. Griffith's Lab. Cambridge.)

S.C. = Subcutaneous ; I.V. = Intravenous.

Conclusion.—A bovine strain of normal virulence.

Case No. 7.

Goat No. 572.—This goat was slaughtered for food at Mbarara abattoir. The only lesion of tuberculosis was caseation of the mediastinal gland. Films prepared from the caseous material were sent to the laboratory for examination and revealed acid-fast organisms. Two duplicate slides were washed with sterile broth and inoculated into three guinea-pigs.

One guinea-pig showing a large superficial inguinal (adjacent) gland was killed 43 days later and pure cultures were obtained from the caseous gland.

The other two guinea-pigs did not become infected.

A series of small raised dry colonies were seen on the medium after 54 days' incubation. Sub-inoculation on glycerinated and non-glycerinated media showed a flat dry growth with ground-glass-like surface, rather better on the glycerinated medium, after 41 days.

Animal Inoculations.

(1) A guinea-pig inoculated with 1 mg. of culture subcutaneously died 67 days later. *Post-mortem* examination revealed generalised tuberculosis.

(2) A rabbit inoculated with 0·01 mg. of culture intravenously died 75 days later from severe generalised miliary tuberculosis.

Conclusion.—A bovine strain rather below average virulence for the rabbit.

Case No. 8.

Goat No. 940.—This goat was submitted to the tuberculin test with 24 others in Ankole and gave a positive reaction. These were chosen at random from owners in the vicinity of my camp. This animal was housed at night with eight other goats in the hut with the owner and his family. One other goat was also positive to the test. The medical officer, Ankole, very kindly examined the owner and his wives and family, and found them free from clinical signs of tuberculosis.

The tuberculin test (double intradermal) gave the following readings:—

Skin Measurements in mm.

	Original.	24 hrs.	48 hrs.	72 hrs.	Remarks.
Control:	3·8	5·0	4·5	6·0	Hot and painful.
Tuberculin:	4·0	17·5	19·0	24·0	

The goat, which appeared perfectly healthy, was purchased and slaughtered for examination.

Post-mortem Examination.—The carcase was in good condition and well nourished. Both lungs were distended and congested, and were filled with numerous abscesses varying in size from that of a millet seed up to 3 to 4 cm. in diameter. The abscesses contained a greenish-yellow fluid consisting of caseous material. There was a tendency to large cavity formation in the apices of both lungs.

The pleurae showed a fibrinous inflammation with adhesions to the chest wall. The spleen contained one tubercle about the size of a small pea. Acid-fast organisms were numerous in the pus from the lungs, but very rare in the spleen tubercle.

The uterus was gravid and contained two foetuses near to term.

Bacteriological Examination.—A pure culture giving quite a good growth was obtained from the purulent material, which was sub-inoculated on glycerinated and non-glycerinated media. A flat dry growth was seen after a month's incubation, which tended to be rather better on the glycerinated medium.

Animal Inoculations (See overleaf).

Conclusion.—A bovine strain below standard virulence for the rabbit.

Case No. 9.

Goat No. 939.—This was a young female goat the weaned kid of Case No. 8. The history is exactly the same as for Case No. 8. It reacted to the double intradermal tuberculin test as follows:—

Skin Measurements in mm.

	Original.	24 hrs.	48 hrs.	72 hrs.	Remarks.
Control:	3·5	3·5	4·0	5·5	Hot diffuse swelling.
Tuberculin:	3·4	6·3	8·9	18·0	

Animal Inoculations (Case No. 7).

Animal.	Route and Dose.	Killed or Died.	Period of Survival in Days.	Autopsy.
1. Guinea-pig	1 c.c. caseous emulsion S.C.	Killed	113	Generalised tuberculosis.
2. Rabbit	0·01 mg. culture I.V.	Died	61	Severe generalised miliary tuberculosis.
3. „	„ „	„	57	„ „ „

S.C. = Subcutaneous ; I.V. = Intravenous.

This goat appeared perfectly healthy and was purchased and slaughtered.

Post-mortem Examination.—Excellent condition. The lesions were confined to the thoracic cavity. There was marked fibrinous pleurisy with adhesions.

The mediastinal glands were enlarged and full of caseous matter. Both lungs were congested and distended and on section showed innumerable small translucent abscesses scattered throughout the parenchyma. At the apices of both lungs there was a large abscess about 4 cm. in diameter, breaking down with cavity formation.

Numerous acid-fast organisms were present in the purulent material of the abscesses.

Bacteriological Examination.—A dysgonic growth, not improved by glycerine, was obtained directly from the purulent matter in the lungs.

Animal Inoculations.

(1) Rabbit received 0·01 mg. of culture intravenously and died of acute miliary tuberculosis of the lungs and spleen 21 days later.

(2) Guinea-pig received 0·5 c.c. emulsion of purulent material subcutaneously died 77 days later from generalised tuberculosis.

Conclusion.—A bovine strain of standard virulence.

Case No. 10.

Goat No. 2.—This goat was not tested in April as she was within a day or two of parturition. She gave birth to two healthy kids on April 26th, 1935, and was tested on July 23rd, 1935. She gave a positive reaction and was destroyed.

Post-mortem Examination.—Excellent condition. A perfectly normal carcase with the exception of a small tubercle about 4 mm. in diameter in the substance of the intermediate lobe of the left lung. This contained a yellow caseo-calcareous substance.

Films showed no acid-fast organisms.

Bacteriological Examination.—A typical dysgonic growth was obtained after 35 days' incubation, which was not improved on glycerinated medium.

Animal Inoculations.

(1) Guinea-pig inoculated subcutaneously with caseous matter from the lung lesion was killed after 95 days. Autopsy showed advanced generalised tuberculosis.

(2) Rabbit inoculated with 0·01 mg. of 14-day-old culture intravenously died after 32 days of severe generalised miliary tuberculosis.

Conclusion.—A bovine strain of standard virulence.

SUMMARY

(1) The literature on tuberculosis in goats is reviewed.

(2) The subject of tuberculosis in goats in Uganda is discussed.

(3) Details are given of ten cases of tuberculosis in goats in Uganda, all of which were caused by the bovine type of bacillus.

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ATTESTED HERDS

There are now nearly 3,000 attested herds in Britain. In eight months the number in England and Wales has increased from 830 to 2,142. In Scotland there are 850 attested herds. It is expected that the total will exceed the 4,000 mark before the end of the year, when the register will include a number of beef herds which are now being tested under the £1-per-head scheme recently introduced by the Minister of Agriculture and the Secretary for Scotland.

The Veterinary Record
SEPTEMBER 3RD, 1938.

Helminthological Nomenclature

THE usefulness of names as a medium for the exchange of ideas is largely determined by the certainty of their meaning, and particularly does this apply to scientific nomenclature where an arbitrary scheme has been created for the purpose of preventing and eradicating error and confusion in scientific discussion. The number of described species in the animal kingdom has recently been stated by Dr. Calman to be in the neighbourhood of three-quarters of a million and the ever-increasing growth of names is a source of wonderment to those who venture into the fringe of biological work. It is considered probable that between one-quarter and one-third of these names will finally be suppressed as synonyms or set aside as *species inquirendae* so that ample scope still remains for the work of systematists in determining the correct grouping of species and the correct application of names, as well as—might it be said—scope for the confusion of the layman.

Referring to this process of change an American biologist recently said that the whole thing reminded him of the embarrassment that we are sometimes confronted with in these days of easy divorce, when we can never be sure whether the lady we are talking to is Mrs. Smith, or Mrs. Jones, but only that it is the same person we knew for a long time as Mrs. Johnson.

The division of living creatures into genera is, however, a refinement of classification made necessary by the progress of our knowledge of the structure of animal life and the multiplication of names is more properly regarded as a simplifying process than a complication, being a division of the world of living things into orderly groups for isolated study.

In the orderly management of three-quarters of a million names there is an obvious requirement not only for guiding principles but also for definite rules. Unfortunately this was not appreciated until a state of great confusion had already arrived and the International Commission on Zoological Nomenclature has been doing its best during the past 50 years to put things straight.

The work of the Commission dates back to the First International Zoological Congress (Paris, 1889) when R. Blanchard presented a proposed code of international rules. This was discussed again at the Second Congress in Moscow, 1892, when it was formally adopted, although several years passed before agreement could be reached on many of the difficult problems which arose.

Although there is still a marked lack of unanimity on several points concerning the regulation of zoological nomenclature the reform has now gone far enough for teaching institutions to benefit: a move on the part of the British Association of Zoologists has recently led to the standardisation of zoological nomenclature for use in the British Universities and Dr. Oldham's contribution which appears elsewhere in these pages represents a similar move for Veterinary Schools. The article, which first appeared in the *Veterinary Record* of February 23rd, 1929, from the pen of Mr. E. L. Taylor, has been considerably enlarged and its revision and publication in its present form represents a wise step on the part of the N.V.M.A. Advisory Committee on Parasitic Diseases to standardise parasitological nomenclature in the Veterinary Schools of Great Britain and Eire.

There can be little doubt that the various departments of parasitology will take the opportunity of securing reprints of this article for the use of their students and we may hope that the confusion which has been so marked a feature of parasitological nomenclature during the past two decades will henceforth disappear.

DESTRUCTIVE ANIMALS BILL

The Destructive Animals Bill, introduced recently by Lord Sempill, has now been printed and copies can be obtained from H.M. Stationery Office. A memorandum summarising the provisions of the Bill is published by U.L.A.W.S., and copies of it can be obtained from the Hon. Secretary, U.L.A.W.S., 42, Torrington Square, London, W.C.1. The object of the Destructive Animals Bill, 1938, is to give effect to such of the recommendations of the Select Committee on Agriculture (Damage by Rabbits), appointed by the House of Lords in November, 1936, as require legislation. The committee reported in February, 1937 (paper 58 of 1937).

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It is reported that 292 unlicensed stallions are being used in Victoria, Australia. That prevents the Horse Breeding Act from being as effective as it might be in improving the horses of that State.—*Scottish Farmer.*

CLINICAL COMMUNICATION

Tuberculosis in a Sheep

J. F. CRAIG and G. O. DAVIES

Among sheep in this country tuberculosis is acknowledged to be an uncommon disease and that has been attributed in large measure to the open-air life they lead and their want of exposure to infection. Cases of the kind are scattered through the literature and have been cited by Stanley Griffith[1].

The first case was recorded in this country by M'Fadyean in 1898 and a second was described by the same author in 1912. A third case was described by A. K. Fullerton in the same year. But although it would appear that in the first two cases the sheep were infected with mammalian tubercle bacilli, the actual type of the bacilli present was not ascertained. In two further cases described in Griffith's article[1] it was taken that the origin of the disease was alimentary and the type of tubercle bacilli present in both cases was avian, in one case typically so.

Two cases of natural tuberculosis in sheep were described by Jowett[2] which were evidently of bovine origin and another case of bovine origin was noted by Schalk in America. In addition, six cases of tuberculosis in sheep in U.S.A. were investigated by Harshfield and Roderick[3] and shown to be due to tubercle bacilli of the avian type. It is interesting to mention that in their experiments Harshfield and Roderick subjected 21 sheep to infection with tubercle bacilli of the avian type, 18 by ingestion and three by intravenous injection, and although doses were more massive than might be expected in natural transmission, only six of the sheep were found to be infected *post-mortem*. In only one of these positive cases which were infected from one of the original tuberculous sheep was the disease generalised. This would suggest a marked natural resistance on the part of sheep to infection with avian tubercle bacilli. Two cases of tuberculosis in sheep,[4, 5] one of which one of the writers (J. F. C.) saw, were reported in Ireland by Murphy and the evidence there was in favour of a bovine origin.

Tuberculosis in sheep and goats appears to be not uncommon in Uganda and the type of organism responsible is usually bovine. One case is recorded in a sheep where the human type was stated to have been found[6].

In April of last year a case of tuberculosis in a sheep was drawn to the attention of the writers through the courtesy of Mr. Clayton, M.R.C.V.S., Birkenhead. The animal was a cross-bred ewe with a complete permanent dentition, which had been imported from Ireland and slaughtered at the Birkenhead abattoir. The carcase was emaciated.

LESIONS.

The submaxillary lymph glands were enlarged and caseous but the other carcase lymphatic glands were apparently free from lesions.

The mesenteric, hepatic, bronchial and mediastinal glands were greatly enlarged and contained yellow caseo-calcareous centres.

The spleen was normal.

The liver was studded, chiefly near the surface but also in its substance, with small greyish yellow tubercles up to the size of a barley grain. These tubercles were caseous in the centre.

The lungs were both extensively involved. The costal surface was rough and stringy and there were many attachments to the ribs.

Save over the apical lobe of the right lung and the cardiac lobes of the left lung there was little normal lung substance left. The lungs (see photograph) were lumpy and firm, grey and fibroid in section and many caseo-calcareous yellow masses were distributed

Cut surface of lung of sheep showing the extensive areas of caseation.

through the fibrous matrix. These masses varied in size up to that of a pigeon's egg. In some parts the material was caseo-purulent and greenish yellow. Many vomicae were noted where this pus or caseo-pus had accumulated.

Tubercle bacilli in typical beaded form were found in considerable numbers in films of the caseo-pus.

Cultures on egg media were prepared from this pus but the growths were very meagre and took some weeks to develop, and subsequently when transferred to glycerin agar the growths were exceedingly slight or the tubercle bacilli failed to grow altogether.

INOCULATIONS

One guinea-pig and one rabbit were inoculated subcutaneously on the inner side of the thigh with 1 c.c. of a fairly heavy suspension of a culture in normal saline. In addition, two fowls were also inoculated with a similar dose of suspension.

The guinea-pig was found dead 41 days after inoculation and in it the lesions of tuberculosis were extensive. They included a local abscess at the site of inoculation, large caseous tubercles in the precrural, inguinal, popliteal and iliac, bronchial and prepectoral glands and numerous miliary tubercles in the spleen, liver and lungs.

Cultures on egg medium were obtained from the lesions.

The rabbit died 69 days after inoculation. Tuberculous lesions present were extensive and included a large caseo-purulent abscess at the site of inoculation, enlargement and caseation of the precrural, inguinal and sublumbar lymphatic glands, numerous miliary tubercles in the kidneys, lungs and spleen and a few also in the liver. Typical tubercle bacilli were identified in small numbers in the films.

Of the fowls, one died from another cause in 21 days and the second was killed 80 days after inoculation. No lesions of tuberculosis were present in either case.

It is therefore apparent that this case of tuberculosis in sheep was probably of bovine origin.

How the animal came to be affected cannot be ascertained but it is not improbable that it had been grazing on the same pastures as tuberculous cattle and the contamination of the herbage with their discharges was the source of the infection.

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[4]MURPHY. *Vet. Rec.* **15.** New Series. 1488.
[5]———. *Ibid.* **49.** 688.
[6]CARMICHAEL, quoted from *Vet. Bull.* (1938.) **8.** 335.

ABSTRACTS

[The Treatment of Joint-ill in Foals by the Intravenous Injection of Trypaflavine. (Trans. title). SCHUBERT, F. (1938.) *Wien. Tierärztl. Mschr*, **25.** 5. 133-143, 3 refs.]

Owing to the fact that many of the author's clients were too poor to pay for the accepted treatment of joint-ill in their foals, experiments were made with the use of trypaflavine, with most promising results.

Temperatures of the foals are taken daily from birth up to four weeks, and any rise above 101·5° F. is regarded as highly suspicious of the disease.

The amount of trypaflavine injected varies according to age as follows: Foals up to three weeks, 0·4 grammes; up to six weeks, 0·6 grammes; over six weeks, 0·8 grammes. It is injected as a 2 per cent. solution into the jugular vein.

As a rule one injection is sufficient, although out of 35 cases, eight received two injections. One case showed recurrence on two occasions at intervals of three weeks, and received three injections, and ultimately recovered to become a strong, healthy foal. Its mother was one of nine, which had received preventive inoculation without giving any protection to their offspring.

To avoid recurrence, the author suggests taking daily temperatures for a week after injection, and if at the end of this time the foal does not give a normal reading a second injection should be given.

From an analysis of the 35 cases treated, details of which are given, it would appear that the prospects of recovery are small in foals up to seven days old, best results having been obtained in animals affected at two to four weeks.

Several cases treated by means of sera and vaccine showed no improvement, but responded readily to trypaflavine intravenously. Of the 35 cases treated, 28 recovered and seven died.

C. F.

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[The Relation of Certain Physical Factors to Infection with Streptococcic Mastitis. BRYAN, C. S., and TAYLOR, G. E. (1938.) *N. Am. Vet.* **19.** 26-30.]

Two dairy herds were examined for mastitis at monthly intervals, over a period of 4½ years. The tests employed, in decreasing order of efficiency in detecting streptococcus mastitis, were: (1) microscopic test of incubated milk samples; (2) examination of the udder; (3) leucocyte content of the milk; (4) chloride test; (5) thybromol test, and (6) physical examination of milk. At first the presence of

streptococci was determined by culture on blood agar, but later this method was replaced by the microscopic test, *i.e.*, the microscopic examination of milk incubated for twelve hours at 37° C. Cows became infected equally in the front and rear quarters of the udder, but the right side developed the disease more frequently than the left, although this could not be correlated with a tendency to lie more on one side than on the other. There was no apparent age incidence of the disease, but 76 per cent. of the cows became infected during the first three months of their lactation, for which no explanation is offered.

A. W. T.

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[The Pathogenesis of Tuberculosis in Calves. Edwards, S. J. (1937.) *J. Comp. Path. and Therap.* **50.** 4. 377-382.]

This is a particularly interesting paper as it shows (1) that alimentary infection in calves often gives rise to naked-eye tuberculous lesions entirely confined to the organs of the pleural cavity; (2) "the remarkable effectiveness of pasteurisation in dealing with milk highly contaminated with tubercle bacteria," and (3) the reliability of the intradermal tuberculin test in young calves.

Two groups of two- to three-day old bull calves from tuberculin tested Ayrshire herds were housed in two isolated units. These were fed for a period of 12 weeks on bulk milk from ten untested herds, one group on raw milk and the other on the same milk after pasteurisation by the holding method. During the experiment samples of raw and pasteurised milk were injected into guinea-pigs twice weekly. At the end of the feeding-trial the calves were tested with tuberculin by the double intradermal method and then slaughtered and a careful *post-mortem* examination made.

The guinea-pig tests showed 33 out of 47 grouped raw samples to contain viable tubercle bacteria whereas all 45 samples of the same milk pasteurised were negative.

Of 36 calves fed on raw milk, 24 reacted to the tuberculin test and of these, 23 showed naked-eye lesions of tuberculosis on *post-mortem* examination. In every case the lesions were confined to the thoracic cavity, chiefly the bronchial and mediastinal glands and the lungs. Pleurisy was present in two cases. The lesions in the glands were for the most part caseated and in some cases calcification was present. No lesions were found in the mesenteric or pharyngeal glands. It should be noted that microscopic examinations of the various tissues were not made as the experiment was not primarily intended for this study. As the calves were fed from individual numbered buckets fitted at their base with rubber teats, the possibility of respiratory infection can be excluded.

Of the 37 calves which received pasteurised milk, one calf reacted to the intradermal test but a careful examination of the tissue of this calf failed to reveal any lesions and biological tests were negative. The remaining 36 calves did not reveal any evidence of tuberculosis.

G. D.

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[Results of Notification of Tuberculosis in Calves. (Trans. title.) Machens, A. (1938.) *Berl. tierärztl. Wschr.*, May, 1938. **19.** 282-283.]

From August, 1933 to March, 1938, in Braunschweig (Germany) compulsory notification of tuberculosis found at slaughter in calves under three months old was carried out. The source of such tuberculous calves was traced and the cow examined by the local veterinary officer. During this time 151 cows were examined, the ideal method being the taking of samples of bronchial and uterine secretion and milk. Unfortunately, all three samples were not taken from each cow. The following results were obtained:—

122 samples of bronchial secretion	66 positive
144 milk samples	19 positive
86 uterine swabs	51 positive

In all, 87 cows were found by this method to have "open" tuberculosis, one or more samples being found to contain tubercle bacilli, either by direct microscopical examination or by guinea-pig inoculation. The percentage of positive results was greater if all three samples were received (79·8 per cent.) than if only two (39·6 per cent.), or one (29·2 per cent.) were examined.

Of 59 positive animals from which all three samples were examined, five animals gave three positive results and 32 animals gave two positive results, *i.e.*, they were affected with more than one type of "open" tuberculosis.

It is clear that the adoption of this method of notification of tuberculosis found in young calves at slaughter is of very great value in tracing cases of "open" tuberculosis in cows. Of particular interest is the high proportion of cases of uterine tuberculosis.

E. G. W.

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[The So-called Skin-tuberculosis of Cattle. (Trans. title). Krantz, G. T. (1938.) *Skand. Vet. Tidskr.* **28.** 1. 1-26. (English Summary).]

So called skin tuberculosis of cattle has been described in America and 40 similar cases occurring in Sweden are recorded here.

The lesions are usually localised and occur on the distal parts of the legs or the ventral aspect of the chest and abdomen, and appear to be tuberculous granulation tissue. In 32 cases the regional lymph glands were examined and in twelve there were tuberculous-like changes consisting of epithelioid tubercles with some Langerhan's giant cells. In only three cases were the glands tuberculous by macroscopic observation.

Acid-fast rods were demonstrated in 35 of the subcutaneous nodules and in seven of the twelve lymph glands which showed changes suggestive of tuberculosis. Guinea-pigs and rabbits inoculated with material from 19 of the cases failed to develop tuberculosis, and material from eleven cases cultured on to Löwenstein's or Besredka's medium yielded no result.

All the animals reacted to the tuberculin test, 39 to the intracutaneous test and one to the subcutaneous test.

Aetiologically this condition of "so-called skin tuberculosis of cattle" is still unexplained.

A bibliography of 44 references is attached to the article.

R. L.

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[**Tuberculosis in a Giraffe.** (Trans. title.) Nieberle (1938.) *Arch. wiss. prakt. Tierhlk.* **73.** 2. 134-138.]

A giraffe, estimated to be about ten years old, had shown symptoms of severe respiratory distress, which rapidly ended in death. At autopsy the lungs were extensively affected with a tuberculous broncho-pneumonia with numerous bronchiectatic cavities. The bronchial and mediastinal glands were enlarged and firm, but there was no caseation or calcification. There was miliary tuberculosis of the liver, spleen and kidneys. A number of Peyer's patches in the small intestine were the seat of tuberculous ulceration, probably produced by the swallowing of infected bronchial exudate.

The histological picture in the lungs resembled that seen in adult cattle at a period considerably later than the primary infection. No primary lesions of long standing were found in the giraffe. It is suggested that the giraffe possesses a considerable resistance to the tubercle bacillus similar to that attained by the bovine only after an early primary infection.

E. G. W.

A decrease in the number of animals affected by tuberculosis is reported from Cheshire. During the quarter ended June 30th, 1938, 360 animals were reported as suspected of having this disease and 328 were certified as being affected. This is a decrease of 81 on last year.

REPORT

New South Wales

REPORT OF THE DIRECTOR-GENERAL, FOR THE YEAR 1936.

This report, comprising nearly 200 pages, contains a fund of information on the public health of the State, and while it is chiefly of interest to the medical profession, there is much that concerns the veterinarian. Briefly summed up, it may be said that in spite of many difficulties inseparable from a period of necessary economy established gains were held and progress made in certain directions.

Following the Director-General's report are reports by the Government Statistician, the Government Analyst, Chief Sanitary Inspector and the chiefs of the divisions of maternal and baby welfare, communicable diseases, tuberculosis division, industrial hygiene, of three medical officers of health, twelve hospitals and institutions, the microbiological laboratory, and the chief inspector for the Pure Food Act, 1908. From the last-mentioned we find that 14,104 samples of milk were submitted for analysis and that only 202 (slightly over 1·4 per cent.) were below the prescribed standard, while of 163 samples of cream submitted for analysis all conformed to the prescribed standard.

As in the previous year, when we commented on the matter, constant supervision was exercised over butchers for the purpose of suppressing the addition of preparations of sulphurous acid to fresh meat and of 6,896 samples submitted, 259 were found to have been treated with this prohibited preservative: 178 prosecutions followed. Following a complaint of the finding in processed cheese of what appeared to be pieces of glass, samples of the cheese were taken, and analysed and the glass-like crystals proved to be lactose.

Under the heading "Quackery. Advertising of Nostrums and Patent Medicines," it is deplored that the department is hampered by inadequate powers to deal with firms who make extravagant claims in regard to cures. We should imagine that such treatment as seizure and removal from the market—as was adopted in one case (quoted as an example)—would be effective and regret that some of the animal medicine vendors in the British Isles, whose claims are just as extravagant, and are on a par with the case quoted, cannot be treated similarly.

Two experiments of importance were undertaken:—

(1) To ascertain the loss in weight of milk in passing over a water and brine cooler and

the further loss in pasteurizing the same milk, and again passing over the same cooler.

(2) To ascertain the weight of one gallon of milk at varying temperatures.

Summarised, the results of these experiments were as follows:—

The loss in weight of just over 6,000 lbs. of milk received at a temperature of 55° F. and cooled to 34° F. was 16 lbs., or ·31 per cent.

The loss in weight of the same quantity of milk after pasteurizing and holding at 145° F. for 30 minutes and cooling to 40° F. was 48½ lbs. or ·94 per cent.

	lbs.	ozs.	drs.	grs.
At 42·5° C 1 gallon of milk weighed	10	5	7	2
At 55° F. 1 gallon of milk weighed	10	5	2	23
At 77·5° F. 1 gallon of milk weighed	10	4	9	7

The Tuberculosis Division reports a steady increase in its activities. Tuberculosis, of which there were 1,372 notifications and 1,051 deaths, shows a marked decline in the death rate from 1885 to the present year and with the exception of venereal diseases this applies to other infectious diseases such as enteric fever, diphtheria, and scarlet fever. On the other hand, deaths from heart disease and cancer show a rise in recent years.

Much research work is recorded on pulmonary dust fibrosis in the lungs of coal, metalliferous and sandstone miners and other workers in New South Wales.

We gather that a Royal Commission was appointed in 1935 to enquire fully into the milk supply of the Sydney metropolitan area and took considerable evidence during the year, but that its report had not been issued when the Director General's report was published.

LIVESTOCK IN GREAT BRITAIN

The preliminary statements of the 1938 agricultural returns for Great Britain have been issued recently. The feature of the livestock returns since the War has been the steady decline in the number of horses kept, both north and south of the Border. The total for the whole of Great Britain has fallen since last year by 10,600 or a fraction over 1 per cent., with the percentage slightly greater in Scotland than in England. In 15 years the decrease has been 491,000, or 33 per cent. In Scotland all other classes of livestock, including poultry, are more numerous than last year; and in England and Wales cattle, sheep and all classes of poultry except fowls show an increase while the number pigs shows a decrease. Except for the years 1934 to 1936, Scotland's cattle population this year is the highest since the War; and there are more pigs than in any year since the War except 1935. There are more cattle in England and Wales than at any time since the War except 1934, and the number of sheep is the highest since 1933.

N.V.M.A. DIVISIONAL REPORT

Midland Counties V.M.A.*

PRESENTATION TO MR. BROOKE AT BIRMINGHAM MEETING

The quarterly meeting of the Midland Counties Veterinary Medical Association was held at the Midland Hotel, Birmingham, on Thursday, June 16th, 1938. The proceedings were prefaced by a luncheon, given by Mr. H. W. Dawes, the newly elected president, and the guests included: Miss Peake, Messrs. J. Martin, L. C. Tipper, W. H. Brooke, F. Chambers, S. M. Woodward, S. Jennings, H. W. Griffiths, L. W. Heelis, R. H. H. Over, B. DeVine, J. Cormack, P. Abson, W. F. Aston, C. G. Allen, J. W. Conchie, P. M. Evershed, T. J. Maguire, W. R. Watson, W. White, C. S. Hunting, H. W. Steele-Bodger, W. E. Ison, H. Tudor Hughes, H. Yeomans, A. B. Forsyth, A. Fewings, M. L. Dartnell, J. L. Brain, D. Macmaster, R. W. Mellard, J. Robertson, and the Hon. Secretary (Mr. A. A. Forsyth).

Apologies for unavoidable absence were received from Sir Gilbert Barling, Sir Frederick Hobday, Dr. Gamgee, Messrs. D. J. Anthony, G. F. Banham, P. W. Baylis, T. J. Brain, P. J. Byner, T. Chambers, W. J. Dale, F. A. Davidson, J. Drummond, D. Forwell, L. Gamgee, F. L. Gooch, W. W. Grasby, T. C. Graves, R. L. Green, O. V. Gunning, C. Hayward, T. H. Hobson, Richard Hughes, T. O. M. Martin, K. O. Miles, E. O'Neil, C. F. Parsons, C. M. Peatt, E. Ringer, J. Robertson, Jnr., A. Renfrew, H. E. Powell, J. Currie, M. T. Sadler, B. Secker, W. Scott, Trevor Spencer, P. G. M. Thomson, T. Thomson, and W. Trigger.

After the toast of "The King," Mr. DeVine proposed the health of the President. "I have been a member of this Association," he said, "for over 30 years, and for a much longer period than that its affairs have been directed by a member of the Dawes family. Our President succeeded to an hereditary office when he became Secretary, and we were all very anxious that he should follow his father's example and occupy the chair for at least one year. We hope, too, that he will, as his father did before him, return to the secretaryship and fill that office for many years to come. We have the highest admiration for him, not only on personal grounds, but for all that he has done for this Association."

The President, in reply, said his family association with the "Midland," which was of such long standing, was one of which he was very proud. It had led to many happy and

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valued friendships, and the support he received from all the members made the work pleasant and easy. The "Midland" had grown in numbers and in influence until to-day it was second to none among provincial associations. He was pleased to see so many of the older members present on this occasion, and referred specially to Mr. Tipper, who qualified as long ago as 1877, Mr. James Martin, who qualified in 1882, and Mr. Brooke, who has just celebrated his jubilee as a qualified practitioner. It was a pleasure to know that such veterans in the profession maintained their interest in the Association, and their example was one which he hoped the younger members of the Association would follow.

Presentation to Mr. W. H. Brooke

The President went on to make a presentation to Mr. W. H. Brooke. It took the form of a cheque, provided by subscription among the members in appreciation of his many years' work as honorary treasurer. When it was known that Mr. Brooke desired to resign that office, partly on the grounds of failing health and partly because he had ceased to reside in the Midlands, it became the unanimous wish of the members that his services should be suitably recognised. Mr. Brooke was then asked what form he would like the presentation to take and he said he would prefer books, and with the cheque which the President now handed to him he would be able to choose them and buy them himself. He was pleased to say they had persuaded Mr. Brooke to continue in office for another year. The reason was a temporary shuffle of the executive posts, Mr. A. B. Forsyth, who had consented to succeed to the treasurership, having stepped into the breach as honorary secretary for the present year, while he (Mr. Dawes) was President.

"This unselfish act," added the President, "was just like Willie Brooke, as his old friends continue to call him, and I need hardly say we greatly appreciate it. He is one of our oldest members and one of the most popular, and he has the best wishes of all of us for better health and happiness in his retirement."

Mr. Brooke, who was deeply moved by the warmth of his reception when he rose to reply, said that when he was asked what he would like in the way of a gift from the Association, he was tempted to say he wanted nothing at all, because whatever he had done had been a labour of love. He felt, however, that it would seem rather churlish to take such a course, but he could only repeat that in working for the Association the pleasure had been his. He took no special credit to himself, because he had done no more than many others would be willing to do, while so far as his long membership of the Association was concerned, that was a condition which everyone could claim in course of time. The Association had been the life blood of his professional career, and he would advise every young practitioner to join such a movement for the educational, as well as the social benefits which it offered. The "Midland" had prospered because it had been well officered, and he recalled a standing joke which the late Mr. Dawes, their President's father, used to make when he was Secretary—that what the "Midland" did one day, other associations did the next. This demonstration of their goodwill was unnecessary, but it was a joy to him nevertheless, and it was one which he was not likely to forget.

New Members.—The business of the meeting was brief, the first item on the agenda being the election of new members, who had been duly nominated at the previous meeting. On the motion of Mr. Tipper, seconded by Mr. DeVine, they were elected *en bloc* as follows: Mr. C. R. Greenwood, Leicester; Mr. P. N. C. Green, Leamington; Mr. J. Drummond, Tutbury; and Mr. D. Macmaster, Knowle.

Next Place of Meeting.—The Council, which met earlier in the day, asked the Association to consider a suggestion that a visit be paid to the Royal Veterinary College on the occasion of the next quarterly meeting.

The idea of a visit of inspection to the new building was warmly welcomed by all present, but it was felt that next August might not provide a convenient date, with other veterinary functions clashing, and it was accordingly deferred until the November meeting.

It was therefore resolved to hold the next meeting in Birmingham and that an address upon "Diagnostic Methods Used in the new State Veterinary Service" would be an appropriate subject. The date was left to the consideration of the Hon. Secretary.

Treasurer's Statement. — As the Treasurer, Mr. W. H. Brooke, had been unable to attend the annual meeting his statement of accounts was held over, as it had not been audited. He now submitted it in person, duly audited by Mr. S. M. Woodward. It showed a balance in hand of £60 9s. 9d., compared with £58 2s. 2d. the previous year.

The accounts were passed, on the motion of Mr. Tipper, seconded by Mr. DeVine, and the Treasurer was authorised to renew the subscription of £5 5s. 0d. and the special donation of £5 to the Victoria Veterinary Benevolent Fund, and the subscription of £1 1s. 0d. to the National Horse Association.

The President, answering a question, said the Benevolent Fund was doing a magnificent work to his own certain knowledge, and with practically no administrative charges, under the careful direction of Dr. Bullock. The

THIRTEENTH INTERNATIONAL VETERINARY CONGRESS

[Specially Contributed]

We supplement the preliminary account of the proceedings at the Thirteenth International Veterinary Congress held at Zurich and Interlaken from August 21st to 27th, which appeared in our last issue, by the following report, forwarded from Switzerland by our own correspondents.

. . . . . .

At the opening meeting on *Sunday, August 21st*, at 4 p.m., from 1,000 to 1,100 members of the Thirteenth International Veterinary Congress assembled in the Great Hall of the Federal Technical College, University of Zurich, for the opening meeting. The proceedings opened with a brief address by Professor Leclainche, President of the Permanent Committee of the International Veterinary Congresses. Herr Obrecht, representing the Government of the Canton of Zurich, then welcomed the members, and was followed by Professor Flückiger and Dr. Graub, President and Secretary respectively of the Organising Committee of the present Congress. The proceedings concluded with addresses by Official Delegates of the various countries participating in the Congress. Mr. Cabot spoke briefly for Great Britain.

Monday, Tuesday, Wednesday and Thursday were devoted largely to discussion of papers, four or five sectional meetings frequently being held simultaneously. These meetings were all held under one roof in the University. Here not only was there a sufficiency of rooms for the meetings but all information bureaux and the exhibition were accommodated, while members were able to obtain meals at reasonable prices in the students' hostel near-by. Such convenience of arrangement augured well for the success of the Congress.

The numbers attending the Congress must have exceeded expectation, practically every nation being well represented. The large numbers led to some derangement of plans for the social side. The Reception in the University on Sunday evening was very crowded while the numbers wishing to attend some of the outings arranged for the ladies were sometimes under-estimated. The outings themselves were most enjoyable. For the Official Banquet on the Tuesday a large hall with an extension gallery was requisitioned. The dinner began at 8 p.m. and was followed at about 1.30 a.m. by dancing which continued for some hours. The speeches, which were considered by many to be too long for such a function, were given in the middle of the dinner.

On Friday the Congress moved by special train to Interlaken, stopping at Berne *en route* to see this delightful town. That evening a banquet to the official delegates was held while a concert and a wonderful firework display were given at the Kursaal for the benefit of other members. The following evening the members of the Congress were again entertained magnificently at the Kursaal, with excellent music and song, dancing and for some of our members, the tables.

On Saturday morning the closing meeting of the Congress was held and here it was announced that Professor Leclainche was to receive the Budapest Prize and that Sir John M'Fadyean and Dr. Möhler were to be made honorary members.

It was also decided that the Fourteenth International Veterinary Congress should be held in Berlin.

Resolutions

Many resolutions were passed at the Congress, as follows:—

Resolution 1.

1.—The Congress expresses to Dr. du Toit and his colleagues at Onderstepoort its acknowledgment and hearty thanks for his preparation of a list of recognised animal diseases.

2.—The Congress expresses its special gratitude to the Government of South Africa for generously placing printed lists at the disposal of the Congress so that every participant may receive a copy.

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support which this Association gave the fund was very much appreciated, and he would be very sorry if it ceased.

Surgical Demonstrations

The company afterwards proceeded to Holliday Street Wharf, kindly placed at their disposal by Mr. DeVine, Birmingham's Chief Veterinary Officer, where a series of surgical demonstrations were given.

The first of these was the castration of a cryptorchid, skilfully performed by Mr. W. F. Aston.

Mr. C. Formston, of the Royal Veterinary College, gave two demonstrations of canine surgery—the speying of a bitch, and a radical operation for canker in the ear.

The demonstrations were watched with very great interest, and both Mr. Aston and Mr. Formston were thanked for the trouble they had taken.

An enjoyable feature of the afternoon was a comprehensive display of new surgical instruments, sundries and dressings arranged by the courtesy of Messrs. Southalls of Birmingham.

A. A. Forsyth, *Hon. Secretary.*

3.—The Congress requests the National Committee of each participating country, to consider the list during the next four years, and eventually to enlarge and if necessary alter it; an all-embracing summary on an international basis can then be put forward at the next Congress.

Resolution 2.

In order to make it possible for all countries to take part in the International Veterinary Congresses, the printing costs of the Congress and the costs of the offices of the Permanent Committee shall be borne (mainly) by the countries concerned. The costs are to be allotted proportionately to the number of veterinarians in each country. The Permanent Committee shall prepare a rule at the next sitting.

Resolution 3.

For protection against the attempts being made in certain countries to exclude the veterinarian from collaboration in animal breeding, the Thirteenth International Veterinary Congress in Zurich has resolved:—

To request the Government of all countries to enable veterinarians to retain or take over their proper participation in animal breeding.

Resolution 4.

The Congress resolves to provide for an international society for veterinarians who are specially interested in zootechny. This organisation shall facilitate the task of those veterinarians concerned in the science of animal breeding.

Resolution 5.

Motion: Admission of comparative pathology as a subject of discussion at the International Veterinary Congress.

The Congress resolves that comparative pathology be admitted as a subject for discussion at the next Congress and for the future.

Resolution 6.

The Congress resolves:—

(*a*) The basis of a hygienic milk-supply is, that milk for human consumption should come only from healthy cows.

(*b*) Production of supplies for human consumption shall be licensed by the health authorities of the place of consumption and be placed under the control of the official veterinarians of that place.

(*c*) The handling of milk in large collecting depôts serves its proper hygienic purpose only if it is done in the area of consumption and under its control.

(*d*) The collecting depôt shall be a hygienic institution.

Resolution 7.

The Congress recommends to all countries that, as far as possible, all animals should be rendered unconscious before slaughter.

Resolution 8.

The Congress resolves, that a section for Therapeutics of the Domestic Animals. ("Pharmako-Therapie der Haustiere") shall be formed and combined with the section of Veterinary Physiology.

Thirteenth International Veterinary Congress, Zurich—Interlaken.

Interlaken.

August 27th, 1938.

. . . . .

Congress Discussions

We are not attempting to report the discussions in full—these will be abstracted later—but we shall give brief summaries of some of the meetings.

On Monday at 11 *a.m.*, Section III discussed malignant catarrhal fever. M. Rinjard drew attention to the fact that work done during the last nine years had cleared up many controversial points. It had been shown, *e.g.*, that the disease could be transmitted by subcutaneous or intravenous inoculation of blood from affected animals provided that these were suffering from a severe form of the disease. Sheep were apparently carriers and the disease could be transmitted to certain laboratory animals. Infection was not in general spread by contact and a small ecto-parasite or similar agent might be suspected. Du Toit and Wyssmann both emphasised that recent work had shown that malignant catarrhal fever of Europe and "snotsiekte" (South African catarrhal fever) were the same disease and that differences in clinical and other properties might be due only to adaptation to a different environment. In South Africa the natural carrier was the wildebeest. Du Toit took the view that since sheep were clearly not carriers (although in contact) in South Africa the theory which incriminated them in Europe should await further confirmation. Daubney felt it was desirable that virus, *e.g.*, in rabbits' brain, should be exchanged between European and African workers.

Götze described his observations in Germany particularly in regard to the milder forms of the disease.

On Monday at 1.30 *p.m.*, Section III discussed tropical and sub-tropical diseases. Many conditions were considered, the following taking part: du Toit (de Kock, who was to have reported, being absent), Daubney, Lestoquard, Geiger, Schang and Leynen. Reference was made to

the very satisfactory results obtained in horse sickness by immunisation with mouse brain virus, using the four main types of horse sickness virus. There was also considerable discussion on the so-called African swine fever, a disease which shows many points of distinction from the European or North American variety particularly in its high virulence, Geiger putting forward the view that the diseases were not the same and that African swine fever should be renamed. The relation of the various Theileria was dealt with by Lestoquard, du Toit and Daubney. The last also referred to the fact that *T. parva* may sometimes localise in the brain causing the so-called "turning sickness." He also discussed the value of formolised rinderpest vaccine in the control of rinderpest. In West Africa tsetse-fly traps were of considerable value in cleaning infested areas. Leynen, however, remarked that in heavily infested areas in the Belgian Congo, they had not proved of much value.

At 3 p.m. on Monday the Congress met in general session to hear Professor Waldmann describe his work on the production of active immunity in foot-and-mouth disease. The virus is obtained from early lesions in cattle which have been inoculated intracutaneously. The first stage of vaccine preparation consists in the adsorption of the virus on to aluminium hydroxide.

50 litres aluminium hydroxide
10 litres virus lymph
40 litres glycine buffer solution

or similar proportions are mixed together and adjusted to *p*H 9·0. Formalin 0·05 per cent. is then added and the whole incubated at 25° C. for 48 hours, then stored at 3 to 5° C. until tested. Each batch is tested on four cattle. These are vaccinated and seven days later given a test dose of virus.

Production has now reached 1,000 litres per week but it is difficult to accumulate adequate supplies.

As already noted in the *Veterinary Record* (**50**. 30. 952) the vaccine is harmless and sufficient evidence of its value has now been collected to enable Professor Waldmann to state unreservedly that it has proved nearly completely effective. This statement was based on results obtained in herds (some 9,500 animals) on the edge of infected districts and in herds which were vaccinated in large areas through which the disease spread later (some 36,000 animals). Sheep and goats and certain bovines were left unvaccinated and in these the disease followed its normal course. Immunity was compiete at 12 to 14 days, but even in herds which became exposed to infection within five days of vaccination, considerable resistance had developed because only some 20 per cent. of animals became affected and in the majority of these the disease was mild.

Professor Waldmann emphasised the difficulty of preparing adequate supplies of vaccine in the present emergency. The vaccine had been of great value in making it possible to put a ring of actively immunised but non-dangerous cattle around new outbreaks.

Attempts had been made to use culture virus but so far it has not proved successful.

Professor Gerlach (Vienna) then outlined the methods by which he said he had been able to demonstrate the foot-and-mouth disease virus in films, or preferably sections, stained with Victoria Blue, Giemsa's or Lentz's method. Screen projections were given showing various bodies which Professor Gerlach looked upon as different forms of the virus. The preparations were available to members for examination on Tuesday morning.

Before closing the Session the President of the Congress, Professor Flückiger, stated that the German Government had agreed to place vaccine at the disposal of the Permanent Committee of the Congress in order that independent tests might be carried out.

On Tuesday at 10.30 *a.m.*, Section III gave consideration to newer work on the specific genital infections of cattle.

Starri dealt mainly with tuberculosis, brucellosis and trichomoniasis. He referred to the frequency of tuberculosis of the uterus of cows. Brucellosis was not uncommon in bulls. Trichomonas infection has spread considerably and often co-exists with brucella infection making differential diagnosis difficult even by serological test and examinations for trichomonads. The use of communal bulls is the most serious source of spread.

Holth (Norway) referred to the control of contagious abortion on the basis of blood tests. The scheme of eradication introduced in 1927, under which all suspect herds are tested and reactors slaughtered with compensation, had given very satisfactory results. Details for the successive years were given and in conclusion Professor Holth stated that not more than 100 reacting herds were left in the country.

Riedmüller dealt with trichomonas disease and vesicular vaginitis (Bläschenausschlag), illustrating his remarks with photographs. His observations were largely based on the results of his own experimental infections produced with pure culture of *Trichomonas foetus* or filtrates containing material from cases of vesicular vaginitis. In trichomonas infections there was catarrh of the vaginal and uterine mucosa, recurrence of oestrum and in some

cases, abortion or pyometra. There were no vesicular lesions, no tumefaction of the vaginal mucous membrane in females, or sheath in bulls, and no evidence of pain. Such cases agreed with the clinical picture in natural pure infections. In vesicular vaginitis, which can be transmitted by filtrates, there is recurrence of oestrum, vesicle formation, etc., but no abortion.

(*To be continued.*)

Notes and News

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Sept. 5th-9th.—Annual Congress, N.V.M.A., at Glasgow.

Sept. 5th.—Meeting of the Society of Veterinary Practitioners, at Glasgow.

Sept. 8th.—Annual Dinner of the Royal (Dick) Veterinary College Alumnus Association at the Ca'dora Hotel, Glasgow, 6.45 p.m.

Sept. 19th.—Meeting of the Editorial Committee, N.V.M.A., at 36, Gordon Square, W.C.1, 4 p.m.

Sept. 20th.—Applications due for Miss Aleen Cust Veterinary Research Scholarship.
R.C.V.S. Examination Committee Special Meeting.

Oct. 5th.—R.C.V.S. Committee Meetings.

Oct. 6th.—R.C.V.S. Committee Meetings.

Oct. 7th.—R.C.V.S. Committee and Council Meetings.

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PERSONAL

Birth.—Bartholemew. At the Cleveland Nursing Home, Darlington, on August 23rd, to Winifrid, wife of A. L. Bartholemew, M.R.C.V.S., of 32, Elton Road, Darlington, a daughter.

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Holidaying in his native Ulster after an absence of 28 years is Mr. A. C. Kirkpatrick, M.R.C.V.S., of Johannesburg, South Africa, whose home was formerly in Augher, Co. Tyrone. Mr. Kirkpatrick is now assistant director of the Johannesburg abattoir and livestock market. In the course of a world tour, in which he visited the principal South American countries, the United States and Canada, he has been studying abattoir accommodation and livestock marketing methods. He was also an interested visitor to the municipal abattoir in Belfast.

R.C.V.S. OBITUARY

The Late Colonel A. R. Young

Lieut.-Colonel Alexander R. Young, news of whose death in New Zealand we recorded with much regret in a recent issue, was well-known to many of the older residents in Edinburgh and Kincardineshire, where he formerly held important veterinary appointments. He later had a distinguished career in New Zealand.

A native of Scone, Perthshire, Colonel Young graduated at Edinburgh, and was in private practice for a time at Marchburn, Fordoun, and Laurencekirk. He was veterinary inspector to the Corporation of Edinburgh for five years, but most of his professional life in Scotland was spent in Kincardineshire, and for eight years he was veterinary inspector to Kincardine County Council.

He was Convener of the Public Health Committee of Laurencekirk Town Council and a member of the old Parochial Board for a time, and held office as a Police Commissioner until 1892, when the Burgh Police Act came into force.

He went to New Zealand in 1899, joining the New Zealand Department of Agriculture as veterinary surgeon in the following year, and was later transferred to the Defence Department, with which he served as veterinary officer throughout the South African War. He later returned to the service of the Department of Agriculture.

On the outbreak of hostilities in 1914, Colonel Young (then Major) offered his services to the Defence Department, and became Assistant Director of Veterinary Services at Divisional Headquarters. He saw service in Egypt, Gallipoli, and France, and was promoted to the rank of Lieut.-Colonel. In 1918 he was appointed Director of the Livestock Division of the Department of Agriculture, and held that position till 1925, when he retired. He then engaged in farming for some years, going to Wellington to reside in 1933. He was appointed Honorary Veterinary Surgeon to Wellington City Council.

Colonel Young, who died at the age of 78, is survived by his widow, who is a native of Fordoun, Kincardineshire, and two sons, Mr. W. M. Young, of Wellington, and Mr. A. R. Young, of Wanganui.

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FOOT-AND-MOUTH DISEASE

An outbreak of foot-and-mouth disease was confirmed among cattle at Worplesdon, Surrey, at the beginning of the week. The area subject to restrictions in the movement of animals lies in the counties of Surrey, West Sussex, Hampshire, Berkshire, Buckingham, and Middlesex.

The Disease in Austria

A Reuter message from Vienna states that foot-and-mouth disease is at present ravaging many districts of Austria. According to an official statement 6,068 farms in 342 places are infected. This is 3,787 farms and 94 places more than in July. The epidemic is most widespread in Lower Danube Province where it has attacked over 4,000 farms.

The Press office of the Nazi party in Salzburg has issued a notice forbidding all farmers in the infected areas to bring their cattle to the cattle markets. Further spreading of the epidemic would be very serious and would lead to the closing of the cattle markets, the notice adds. Heavy fines are threatened against those who disregard these instructions.

THE BRITISH ASSOCIATION

(*Continued from page* 1126.)

Scope for More Livestock

Towards the end of the Cambridge meeting of the British Association for the Advancement of Science, problems of livestock production engaged the attention of the Agricultural Section when Professor R. Rae, of Cambridge, opened the discussion with a review of animal husbandry in this country to-day.

The output of livestock and their products formed, he said, 70 to 80 per cent. of the total agricultural output, yet we did not produce anything like sufficient livestock products for the country's needs, except perhaps in fresh milk. This low *per capita* production, as compared with consumption, meant that there was scope for much further development in this branch of agriculture. But it was an industry largely dependent at present on imported feeding stuffs, hence the emphasis now laid on the necessity for increasing the home yield of the food for our livestock.

The order of efficiency of the conversion of livestock feeding crops into yield of livestock was given by the late Professor Wood as (1) cow, (2) pig, (3) fowl, (4) sheep. In the case of the cow, concentrates might be relied on to supplement the pastures in increasing the milk yield, and dried young grass might help to solve the problem; but for the specialised pig and poultry industries there was still dependence on a plentiful supply of imported food. Sheep perhaps could get along with a reduced supply, though naturally with a slower rate of production.

In general, the larger the number of livestock, the larger the store which could be called on in case of emergency, and this not for direct consumption alone but for maintaining the fertility of the soil.

On the large farms the lack of skilled workers in animal husbandry was already being felt, and with this problem was linked that of keeping the best of the young men of the agricultural population on the land at all and also the problem of attracting to farming boys approaching working age. It was naturally the keen, intelligent, and ambitious young men that agriculturists desired to retain, and he considered the institution of some form of apprenticeship essential. It was also essential to avoid putting the intelligent boy to a series of odd jobs which would end in his being a jack-of-all-trades and master of none.

Probably the greatest problem of all in livestock industry to-day was breeding. Our present systems needed reviewing to make sure that our livestock production was not being maintained at the expense of lowered vitality. Maximum milk and egg and bacon production were not the real criteria: the real criterion was whether we were keeping up the purity and health and reproductive power of our livestock. The law of diminishing returns so often quoted and illustrated from crops applied with equal force to livestock also.

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VETERINARIAN'S BATTERY BRINGS DOWN A "QUEEN BEE"

We are interested to learn from the *West Somerset Free Press* that, on the occasion of the recent visit of the Secretary of State for War to the A.A. Practice Camp at Watchet, "it fell to a battery from Pentonville, the 171st (Major G. M. Bushman, M.C.)"—a member of our profession—"one of the units in the 61st A.A. Brigade, R.A. (T.A.), to open the shooting and, incidentally, further to distinguish themselves." The reference is to the feat of a gun crew of Section B of the battery in bringing down a Queen Bee (radio controlled) aeroplane, then doing runs at 100 miles an hour at a height of 3,000 feet and about two-and-a-half miles from the shore, upon which achievement the battery was warmly congratulated by Mr. Hore Belisha. The account continues: "The feat was all the more remarkable by reason of the fact that the battery was making its first appearance on the range this season. Twelve months ago, the same battery, in the course of half-a-dozen rounds, brought down a Queen Bee at a very similar range, and they have now the distinction of being the only battery in the British Army, Regular or Territorial, to have brought off what may be termed a "double kill" in anti-aircraft exercises.

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LEGAL NOTES

Complaint of Barking Dogs: Summons Dismissed.—At Greenwich Police Court on August 24th, Mr. F. E. Somer, F.R.C.V.S., of Shardeloes Road, New Cross, was summoned by Mrs. Doris Smithson on behalf of Percy Smithson, of Brindley Street, New Cross, for keeping dogs, the barking of which at night, it was alleged, prevented sleep and constituted a nuisance.

Mr. J. A. T. Good appeared for defendant, who pleaded not guilty.

Complainant said that defendant kept several dogs on premises abutting on to houses in Brindley Street. Witness moved in the street three months ago and the noise had been going on since then night and day.

He had complained to Mr. Somers' assistant, but the noise continued. Defendant was communicated with and he said to witness that he was sorry about the noise and would do all he could to abate it. A petition was signed by other residents and since then there had been a little less noise.

Cross-examined, complainant said he had not complained about motor cycles and children.

Mr. Somer, on oath, said he had been practising as a veterinary surgeon for a considerable number of years and he gave several thousands of pounds for the premises and goodwill. He purchased them ten years ago and the surgery had now been in existence for 30 years. He had a well equipped modern hospital for animals and conducted operations upon them. At this time of the year dogs were taken in as boarders. "If a dog is noisy we try to get him home as soon as we can," said Mr. Somer. "We also refuse to have him in future again." At the present time he had about 30 dogs, comprising 15 cases and 15 boarders, and he employed four men.

Mrs. A. Warren, of 6, Brindley Street George Reeve, of the same address, and William Henry Gough, of 17, Brindley Street, gave evidence that the dogs did not disturb them.

Thomas George James Barker, head kennelman to Mr. Somer, said everything was done to keep the noise down.

Mr. Bernard Campion, K.C., said he was convinced that in the past there had been too much noise from these kennels, particularly during holiday time, but he was satisfied that Mr. Somer had done all he could to prevent it becoming

a serious nuisance. He only hoped the improvement would continue.

The summons was dismissed.

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The suggestion that it was less cruel to hit pigs on the head with a hammer than to use the humane killer was made by William Milburn (65), slaughterer, charged at the Grimsby Police Court with breaches of the Slaughter of Animals Act. He pleaded guilty. The Chairman said that while the Bench appreciated Milburn's point of view that it might be less cruel to use a hammer, he must nevertheless comply with the law.

Correspondence

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

All correspondence must bear the name and address of the contributor for publication.

The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

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"SOME RECENT ADVANCES IN VETERINARY PHYSIOLOGY AND THEIR CLINICAL APPLICATION"

To the Editor of the Veterinary Record

Sir,—When Mr. W. P. Blount read his paper on "Some Recent Advances in Veterinary Physiology and their Clinical Application" to the Central Division of the N.V.M.A. (*Veterinary Record* of July 9th, 1938) he received some rather stern criticism on the grounds of inaccuracy and undue discursiveness, but both he and his critics delighted an unseen audience of which I cannot have been the only member. The *Veterinary Record* speaks to a larger and less well-informed group of hearers than Mr. Blount's critics, and but for his moral courage and enthusiasm it might be long before some of us in distant places would have learned the vital facts disclosed both in the original paper or in the criticisms of it.

For the sake of the truths one gladly forgives the inaccuracies his paper contains: for instance, even a clinician might discern the error in Mr. Blount's belittling of the value of the copper sulphate technique in the closure of the oesophageal groove to facilitate the chemical attack on parasites in the fourth stomach of sheep. But Mr. Ottaway, in his eloquent correction of that slip, more than compensated for the mistake.

A letter is far too brief a medium to chronicle the applications a clinician may discern in the researches described in Mr. Blount's paper and in the discussion that ensued, but here are one or two of outstanding interest to me.

I now know precisely, or almost precisely, why excitable horses and hounds are apt to be unduly loose in the bowels and hard to keep in condition and I realise why it has never been possible to correct this by means of drugs. I now perceive more exactly why much empirical drug treatment and many drug-habits, such as alchoholism, prejudice health by interfering with the normal chemical life of the cell. Conversely I understand why homeopathy often proved preferable to allopathy when no one really knew anything about the action of either. The main cause of chronic constipation in leisured and sedentary maiden ladies and comfortable gentlemen never subjected to any sort of excitement from maturity to the grave, is now apparent to me. The action of tobacco smoking in rectifying that absence of excitation of nerve terminals, and consequently assisting defaecation, is now explained. The magic influence of the early morning smoke in this connection is evidently due to the fact that inhaled tobacco smoke on an empty stomach either excites the nerves that secrete acetyl-cholin or depresses the nerves that are concerned in antagonising the secretion.

At last I can explain to myself, if not to my clients, just why I am justified in my detestation of the all-too conventional doses of linseed oil in the treatment of digestive disorders of the horse. Papers like that of Mr. Blount are only dangerous in so far as his academic enthusiasm may lead his ingenious young male and female contemporaries to press too far such theories as that eserine must be useful in the treatment of colic because it is said to inhibit esterase. Eserine and the like have been tried for more than 20 years and there is no proof that they have cured more cases than they have killed. I have never forgiven eserine for one incident with which I will conclude this too discursive commentary.

The "case" was that of a milch cow at Suva, in Fiji, the beloved property of a fellow civil servant in a place where good milch cows were scarce. The disease that struck down the cow was a new one in my clinical experience, nor could I find a text book with an exact description of it. An acute catarrhal inflammation simultaneously attacked every visible mucous membrane and all function seemed to be suspended to a greater or less extent. This went on for a week, during which the cow did not defaecate and was not seen to urinate, and then there came a change for the better with the difficult passing of some dry faeces.

Up to then, not knowing what medicine to give, I had rightly given none, but now, instead of relying on enemata and patience, I weakly succumbed to the urging of the owner and did a fatal thing in an ill-advised effort to help the cow, I injected half a grain of eserine and saw the animal faint beneath my hand and die in less than five minutes from the time of the injection, In retrospect it was obviously foolish of me, but experience was necessary to show me what a deadly poison eserine could be. The mouth and fauces were still too sore for drenching, and eserine happened to be the only intestinal stimulant drug suitable for hypodermic injection in the limited equipment at my disposal at the time. The shame of that moment is with me still. My conscience compelled me to buy a new cow for the bereaved owner, but I could not find as good a cow as the one I killed and that would surely have recovered but for that cursed eserine,

Yours faithfully,

Wakefield Rainey.

Bloemfontein,
South Africa.
August 12th, 1938.

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PATHOGENIC ORGANISMS AND FOWL PARALYSIS

To the Editor of the Veterinary Record

Sir,—In a letter to the *Record* for August 20th, Mr. W. P. Blount invited me to reply to certain queries concerning my paper "Pathogenic Organisms and Fowl Paralysis." I must apologise to Mr. Blount for the delay caused by holidays in presenting the following answers to his questions.

Q. 1.—What wild birds has he (Mr. Gray) found suffering from true fowl paralysis?

A.—There is a difference of opinion over the meaning of the term *true* fowl paralysis. What I term and am satisfied is true paralysis I have seen, for example, in a grouse, suffering from enteritis due to the roundworm *Capillaria* and completely paralysed in one leg and partially paralysed in the other; in a tnrush suffering from caecal coccidiosis and whose wings were drooping; and in a starling also affected with caecal coccidiosis and which was quite unable to stand, being paralysed in both legs. All these three cases were markedly emaciated.

Q. 2.—What is his (Mr. Gray's) evidence that waste protein products are thrown back into the duodenum to be associated with innumerable petechiae in nephritis in fowls?

A.—In congestive nephritis in birds and in that form of nephritis approaching the condition known as visceral gout of fowls I have found the duodenal lining studded and stained with small haemorrhages which histologically were found to be patches of congestion in the mucous and sub-mucous coats. Visceral gout in fowls is held to be the result of feeding rations of high nitrogenous content. The analogy between these petechiae in birds found associated with nephritis resulting from feeding rations of high protein content and that condition of hyperaemia of the upper third of the splanchnic viscera found associated with well-established nephritis of quadrupeds and primates seems permissible, for the picture of the gross pathological changes is the same in all vertebrates.

Q. 3.—Concerning the pathogenic bacteria isolated is he (Mr. Gray) . . . satisfied that these can be isolated from birds killed and examined whilst still warm?

A. The importance of this point was early recognised by the writer, and after the appearance of the first organisms, several birds brought alive in a paralysed condition into the laboratory were killed and the nerves examined immediately after death, when the bird was still warm and before any other of the routine examinations were carried out. In only one instance did the organisms described fail to appear from preparations of such fresh nerves.

*Q.*4.—What are the common errors he (Mr. Gray) has found in relation to the wrongful feeding of poultry associated with intestinal parasitism and fowl paralysis?

A.—All those general factors which through badly balanced rations, or rations of poor quality, or rations insufficient in quantity, lower the bird's resistance, and render it more prone to parasitic infestation: for example, throwing food on to the ground, where it is picked up by birds together with eggs or coccidial parasites passed by sick birds: or a recent case of the author's, where feeding of alfalfa containing 7 per cent. more than the specified percentage of fibre caused cloudy swelling and subsequent fatty degeneration in the liver and in the kidney tubules, of a batch of chicks. A *post-mortem* examination on one of these chicks revealed two coccidial oöcysts in the caecum, but no symptoms of coccidiosis appeared subsequently when the quality of the alfalfa was rectified.

Yours faithfully,
Ernest Gray.

East Anglian Institute,
Chelmsford.
August 30th, 1938.

The Editor acknowledges, with thanks, the receipt of the following: Communications from Mr. Harvey S. Purchase (Watford) and Mr. D. L. Robarts (St. Albans); reports of meetings of the Dumfries and Galloway and North of Ireland Divisions, N.V.M.A.; Calendar (1938-39) of the Royal (Dick) Veterinary College, Edinburgh.

DISEASES OF ANIMALS ACTS, 1894 to 1937, and AGRICULTURE ACT of 1937 (PART IV)

SUMMARY OF RETURNS

Period.	Anthrax.		Foot-and-Mouth Disease.		Parasitic§ Mange.		Sheep Scab.	Swine Fever.	
	Outbreaks confirmed.	Animals attacked.	Outbreaks confirmed.	Animals slaughtered as diseased or exposed to infection.	Outbreaks reported by the Local Authorities.	Animals attacked.	Outbreaks confirmed.	Outbreaks confirmed.	Swine slaughtered.
	No.	No.	No.	No.	No.	No.	No.	No.	No.
Period 1st to 15th Aug., 1938	26	316	—	—	—	—	2	33	31
Corresponding period in									
1937	15	17	4	827	1	1	2	34	11
1936	16	19	—	—	2	2	7	71	33
1935	8	10	—	—	2	2	8	72	56
Total 1st January to 15th Aug., 1938	561	908	157	20,258	42	70	107	410	290
Corresponding period in									
1937	472	573	19	4,473	88	125	133	722	438
1936	304	360	4	379	82	223	154	1,303	927
1935	233	270	34	10,208	81	166	214	1,254	738

Note.—The figures for the current year are approximate only. § Excluding outbreaks in Army Horses.

CONTAGIOUS DISEASES OF THE PIG

BACTERIAL SWINE FEVER

Serum P.N.— Curative Serum
(Laigle Laboratory)

Affords immediate protection to animals actually affected. Immunity lasts from four to six weeks.

Ampoule of 10 c.cs. **1/-**

Susor — Preventive Vaccine
(Laigle Laboratory)

This vaccine is detoxicated and may be given to young pigs without fear of reactions. Immunity lasts from four to six months and becomes effective about one week after vaccination.

Ampoule of 10 c.cs. (5 to 10 doses) **2/-**

SWINE ERYSIPELAS

Anti-Erysipelas Serum
(Toulouse Laboratory)—

For curative treatment of affected animals.

Flask of 10 c.cs. **1/4**

Anti-Erysipelas Vaccine
(Pasteur Institute.) For prophylaxis.

Two tubes containing 10 doses of "First Vaccine" and 10 doses of "Second Vaccine," respectively. Immunity becomes established 10/15 days after the injection of the "Second Vaccine."

Two tubes containing 10 double doses **1/9**

The above products are supplied to Veterinary Surgeons only. Practitioners desiring further information are invited to write for descriptive leaflets giving the full technique of use, to:—

THE VETERINARY DEPT.

GENATOSAN LTD.

LOUGHBOROUGH LEICESTERSHIRE

Telephone: Loughborough 2292. *Telegrams:* "Genatosan, Loughborough."

NOTICES

ORIGINAL Articles are only accepted on the understanding that the "Veterinary Record" has priority of publication.

THE Editorial Committee of the N.V.M.A. will be glad to receive from practitioners reports of cases likely to prove of interest to readers of this journal.

"VETERINARY RECORD" AND CHANGES OF ADDRESS

READERS are asked to inform the General Secretary of any change in their address by THURSDAY MORNING if they wish the following Saturday's issue of "The Veterinary Record" to be sent to the new address.

The publication of this notice is prompted by the recent increase in the number of readers who notify change of address on Friday and Saturday, when it is too late for any alteration to be effected before the following week.

Society of Veterinary Practitioners (Division, N.V.M.A.)

NOTICE is hereby given that a Meeting of the members of the above Society will be held on Monday, 5th September, in the Concert Hall of the Empire Exhibition, immediately following the conclusion of the paper on Virus Diseases.

THE AGENDA WILL BE—

1. Short Discussion on the Working of the new Centralised Veterinary Service to date.
2. Any other business.

T. A. R. CHIPPERFIELD, *Hon. Secretary.*

Royal (Dick) Veterinary College

ALUMNUS ASSOCIATION

THE Annual Dinner will be held in the Ca'dora Hotel, Glasgow, on Thursday, September 8th, at 6.45 p.m. A large attendance is requested to meet Sir Arthur Olver, C.B., C.M.G., F.R.C.V.S., Principal, Royal (Dick) Veterinary College.

Lincolnshire and District Division, N.V.M.A.

REFRESHER COURSE IN POULTRY DISEASE AND HUSBANDRY

A REFRESHER COURSE in Poultry Disease and Husbandry has been arranged for the above Society and other practitioners, to be held at the George Hotel, Grantham. The lectures will be from 6 to 8 p.m., on September 14th, 19th, 21st, 25th, and 30th, and a practical demonstration will also be given at the Midland Agricultural College, on October 5th. Mr. Ironside, M.R.C.V.S., will lecture on poultry disease and Mr. Shaw from the Midland Agricultural College on poultry husbandry.

For further particulars please apply to the Hon. Secretary, W. Gibson, 35, Avenue Road, Grantham.

Professional Advertisements

These will be received up to Wednesday morning. Five lines or under, 3/6; or two insertions 5/-; for three, 6/6. Each line above five—first insertion, 8d.; after first, 4d. Average—seven words in a line.

These Advertisements will not be inserted unless prepaid, and if replies are to be received at this office an extra shilling must be included. **Replies to Box Numbers should be addressed to the appropriate Box at the Office.**

Office Address:
36, GORDON SQUARE, LONDON, W.C.1.

APPOINTMENTS VACANT

APPLICANTS for posts are requested not to enclose original testimonials when replying to advertisements. Copies answer the same purpose and cause no inconvenience if mislaid.

Sudan Government

APPLICATIONS are invited for a post of Veterinary Inspector in the Sudan Veterinary Service. Salary £E.540 or £E.600 per annum (£E.1=£1 0s. 6d.) according to qualifications and experience. After two years' satisfactory probationary service, and subject to passing the necessary examination in Arabic, candidates will be enlisted in the permanent service, with biennial increases of pay to £E.852 and a final increase after three more years to £E. 936, and will be eligible for posts of Senior Veterinary Inspector with a maximum salary of £E.1,200.

Free passage on appointment. Strict medical examination.

Candidates must be members of the Royal College of Veterinary Surgeons, unmarried and preferably under the age of 27 years.

The selected candidate would be required to proceed to the Sudan about the end of October.

Applications will be received up to September 15th, 1938, by the Controller, Sudan Government London Office, Wellington House, Buckingham Gate, London, S.W.1, from whom further particulars are available. Envelopes should be marked "Veterinary Inspector."

Glasgow Veterinary College
(INCORPORATED),
83, Buccleuch Street, Glasgow.

APPLICATIONS are invited for the Professorship of Biology. The appointment is a whole time one and is limited to members of the Royal College of Veterinary Surgeons.

Initial Salary from £350 to £500 according to experience.

Applicants should forward full particulars to The Secretary, Glasgow Veterinary College, 149, Ingram Street, Glasgow, C.1.

BLUE CROSS KENNELS, Shooters Hill Road, London, S.E.18, 'phone Woolwich 1800 (Local Institution of Our Dumb Friends' League). Post of Resident Veterinary Surgeon will shortly become vacant owing to marriage of present holder; previous vacancy caused in same way. Applications invited (unmarried, either sex); salary £4 4s. weekly with furnished quarters, light, heat, laundry, attendance, etc.—Replies to Hon. Secretary giving age, experience, and references.